The TRIUMF Users’ Group (TUG) AGM was held on December 10, 2003, and the 2004 TRIUMF Users’ Executive Committee (TUEC) was announced. The Chair is Jeff Sonier (SFU) and the Chair Elect is Jens Dilling (TRIUMF); Past Chair, Des Ramsay (Manitoba); Members, Alan Chen (McMaster) (2003-2004), Tracy Porcelli (Northern BC) (2003-2004), Pierre Bricault (TRIUMF) (2004-2005), and Alison Laird (York, UK) (2004-2005). In addition, TUEC nominates two members to the TRIUMF Operating Committee (OPCOM) to represent the views of the Users. Presently, they are: Graeme Luke (McMaster), alternate Jeff Sonier (SFU); and, Stan Yen (TRIUMF), alternate Larry Lee (Manitoba).

One of the main concerns raised during the AGM Open Forum session was the changing priorities of the TRIUMF experimental program and its Users, mainly due to the new ISAC facility. At the January 2004 TUEC meeting it was noted that many of these concerns could be addressed by revitalizing the link between TUEC and the user community at large. All interested parties are invited to become TUG members in order to obtain the agenda for future meetings, which will be circulated in advance, and to review the minutes posted on the TUG Web site.

An ad hoc TUEC committee was struck which met with the Head of the ISAC division, Paul Schmor, to discuss a variety of Users’ concerns. Moreover, TRIUMF has established an ISAC Beam Strategy Committee to foster and advise on the development of radioactive beams for ISAC. Developments and first-offline tests of the negative ion, laser ion, and... continued on back page
A New Probe for Condensed Matter Research

Radioactive ion beams from ISAC have applications in condensed matter in addition to nuclear physics and nuclear astrophysics. We have recently polarized a beam of $^6$Li to use as a magnetic probe of ultra thin films and interfaces. This application is based on the technique of beta detected nuclear magnetic resonance ($\beta$-NMR) which requires about 10 orders of magnitude fewer nuclear spins than conventional NMR. The unparalleled sensitivity of $\beta$-NMR comes from the fact that the signal is detected through the beta decay of a polarized radioactive nucleus. The polarized beam line and spectrometers at ISAC are being developed to probe the magnetic and electrical properties of interfaces, nano-structures, and ultra-thin films. The scientific applications arise from the fact that it is virtually impossible to get equivalent NMR information on the host nuclear spins.

Depth profiling with $\beta$-NMR was demonstrated by implanting the beam into a 19 nm thick silver (Ag) film grown on a single crystal of magnesium oxide (MgO). Fig. 1a shows the resulting $\beta$-NMR frequency spectrum of $^6$Li at a beam energy of 1 keV where the beam stops in the Ag film. The lower line is attributed to the MgO substrate and dominates at higher implantation energies. The two higher frequency lines are attributed to $^6$Li at two different crystalline sites in the Ag film. All the lines are remarkably sharp confirming that the implanted Li resides in sites that are well away from any radiation damage. Since Ag is relatively inert and can be easily evaporated onto any surface, one could use the $\beta$-NMR resonance to measure the magnetic field distribution near the surface of a material with a resolution of about 0.5 G. In this way the polarized low energy beam can be used as a kind of local magnetometer.

All measurements using proton and $\alpha$ beams were done at the Center for Nuclear Physics and Astrophysics at the University of Groningen. The TRIUMF-Seattle $^7$Be($p,\gamma$)$^8$B Experiment

While the $^7$Be($p,\gamma$)$^8$B reaction is a very small branch in the solar pp-chain, the $\beta$-decay of $^8$B produces the only high energy solar neutrinos that can be detected by water based neutrino detectors. For a long time, both chemical and water based neutrino detectors have seen a deficit in electron neutrinos compared to the numbers predicted by models. Recently a collaboration using the heavy-water based Canadian SNO detector has shown that the apparent electron neutrino deficit is caused by oscillations of the solar electron neutrinos into at least one other flavor.

To better understand the parameters of neutrino oscillations and to improve the solar models, the nuclear reactions of the $pp$-chain have to be well understood at the energies where they happen in the sun. In particular, the $^7$Be($p,\gamma$)$^8$B reaction has an inherently small cross section and requires the use of a radioactive $^7$Be ($T_{1/2}=53.29$ d) target or beam to measure the cross section.

At TRIUMF we have produced a $^7$Be target with unprecedented purity to avoid some of the problems encountered in previous measurements. The $^7$Be on the target backing was concentrated into a small spot of about 3 mm diameter, while the proton beam was swept over this target. This ensured in first order that only the total number, and not the distribution, of $^7$Be atoms is important in the cross section evaluation.

All measurements using proton and $\alpha$ beams were done at the Center for Nuclear Physics and Astrophysics at the University of Washington (Seattle) covering centre-of-mass energies from 116 to 2485 keV for protons. Possible systematic errors were checked in separate measurements, among them a $^8$B backscattering set-up that measured the loss of $^8$B at the $^7$Be target activation. Such a measurement has never been attempted by any other group. Three different targets were used to obtain the final result. Typical S-factors for zero energies are quoted in the literature. Fig. 1 shows a comparison of $S_\gamma(0)$ with other previous measurements using a direct determination of the $^7$Be($p,\gamma$)$^8$B reaction cross section.

Clearly, the data point obtained in the TRIUMF-Seattle experiment has the smallest error bars. The TRIUMF-Seattle data also shows an energy dependence which is consistent with other direct measurements but not consistent with indirect Coulomb dissociation experiments. The averaged $S_\gamma(0)$ for data below 425 keV is $21.4\pm0.5$ (exp.) $\pm0.6$ (extrap) keV$\cdot$b. This is slightly higher than previously recommended and allows in principle for some sterile neutrino admixture.

**For more information, please refer to A. Junghans, et al., PRC 68 (2003) 065803**
EMMA: ElectroMagnetic Mass Analyzer

On December 11-12 2003, a workshop was held to discuss the physics opportunities that would be afforded by a recoil mass spectrometer at ISAC-II, dubbed EMMA (ElectroMagnetic Mass Analyzer). The main goals of the workshop were identifying the important physics questions to be studied with a recoil mass spectrometer and specifying the essential characteristics it would require to meet the needs of the experimental community.

Among the 30 participants in the workshop were experimenters from Canada, France, Italy, the UK, and the USA. Attendees included mainly Canadian, British, and American prospective users of EMMA, as well as several scientists involved in the design and operation of comparable spectrometers around the world.

Following an introduction describing the beams that will be provided by ISAC-II, the talks concentrated on three topics: the properties, limitations, and figures of merit of recoil mass spectrometers in general; classes and specific examples of reactions of interest; and the design parameters of a recoil separator that would allow experimenters to study these reactions most efficiently. The main classes of devices currently in use or under construction were discussed: large acceptance magnetic spectrometers, recoil mass spectrometers that contain both electric and magnetic bending elements, and hybrid devices that seek to combine the features of these classes in a single design where elements can be turned on or off according to the needs of a specific experiment.

Issues discussed were the unavoidable trade-off between mass resolving power and large energy or angular acceptance, due to geometric and chromatic aberrations, and the fact that purely magnetic devices do not produce any physical separation between different masses, a serious limitation of such spectrometers. In both magnetic spectrometers and hybrid devices, measurements of the recoil time of flight through the device are required to achieve even the modest mass resolution of which they are capable. Presentations from those operating and building such devices indicated that the mass resolving power of these spectrometers is inadequate for many if not most of the experiments envisioned by those expressing interest in using a recoil spectrometer at ISAC-II.

As a result, the ongoing design effort focuses on improving the designs of combined electric and magnetic recoil mass spectrometers built throughout the world in the 1980s and 1990s by increasing their angular and energy acceptances without unacceptable sacrifices in mass resolution, mass acceptance, or beam suppression. Considerable success along these lines has already been achieved in design studies following the workshop (see figure). The current plan calls for a funding proposal based on these design studies to be submitted to NSERC in September 2004.

Barry Davids

TIGRESS

Descriptions of nuclear structure deduced from the long-lived isotopes of day-to-day existence are not appropriate for nuclei far from stability whose structure is relevant to, for example, stellar nucleosynthesis environments. Breakdown of shell structure, emergence of new “magic” numbers, and formation of neutron-proton pair condensates are all predicted modes of nuclear behaviour that can be probed with ISAC-II exotic heavy-ion beams that should be available in 2005. The energy of these beams should be above the Coulomb barrier of many projectile-target combinations of interest. Population of excited states with these projectiles will produce gamma rays which could be Doppler energy shifted by up to 10% of their energy. Much of the information of the predicted modes of nuclear behaviour is contained within the intrinsic properties of these gamma rays. It is therefore essential to correct for those Doppler shifts while preserving high efficiency, as is done with Exogam and Miniball.

The TRIUMF-ISAC Gamma-Ray Escape Suppressed Spectrometer (TIGRESS) combines the proven technologies of multi-crystal high-purity germanium (HPGe) “clover” detectors and scintillator-based escape suppression, with high outer-contact electrical segmentation and digital signal processing, to measure gamma ray production in ISAC-II experiments. The clover technology provides high absolute efficiency, while the escape suppressors reduce continuum background from gamma rays that are not fully absorbed in the HPGe. Analysis of the pulse shapes of the highly segmented outer contacts is expected to determine the angle of gamma ray emission in the lab frame to ~3°, compared with the ~20° subtended by each crystal. This will bring the emission-angle Doppler-broadening component of an 800 keV gamma ray from a source moving at 5% the speed of light (typical of ISAC-II experiments) to 2.1 keV, comparing favourably to 1.8 keV intrinsic HPGe resolution and 13 keV broadening one would obtain with unsegmented crystals in the same array.

A prototype HPGe module was funded by the Canadian Foundation for Innovation, Ontario Innovation Trust, the University of Guelph, and TRIUMF, and is shown in the photo to the left. This test determined that the detector was capable of <2 mm lateral position resolution for single interactions, well within the limits needed to obtain the afore-mentioned angular resolution. Following a technical review of the prototype detector in July 2003, the Natural Science and Engineering Research Council (NSERC) released funds to begin construction of a 12-detector array to be completed in 2009. A subarray is expected to be ready for the first ISAC-II beams. The TIGRESS collaboration comprises researchers from University of Guelph, McMaster University, Université de Montréal, University of Toronto, Université Laval, Simon Fraser University, and TRIUMF.

Greg Hackman
TRIUMF Back Page

TRIUMF Beam Schedule
The current TRIUMF beam schedule is available on the Web at: https://admin.triumf.ca/docs/eec/
Users should subscribe to the automated update notification to receive notice of any changes which may be required during the period already scheduled.

TUEC News

continued from first page ...

FEBIAD-type ion sources, plus the ongoing tests of the on-line ECR ion source, were discussed at the inaugural February 27th meeting. Tests and the status of high-power targets were also reported. Priorities and financial resources for the various developments will depend on approved experiments and User demand for relevant beams. One consequence of the meeting was the reactivation of the actinide target task force (ATTF), now led by John Behr (TRIUMF). It is planning safety tests of alpha-emitting species with the goal to obtain the licence to produce and run the uranium and thorium targets which are crucial for the production of radioactive beams for already approved high priority experiments. The interim report of the ATTF can be found on the TUG Web site. Each member of TUEC is to be regarded as a member-at-large, and TRIUMF Users are strongly encouraged to provide frequent input to any members so that action can be taken on their behalf.

Martin Comyn and Jens Dilling
To join TUG or contact TUEC members, please visit the TRIUMF Users’ Group Web site at www.triumf.ca/tug/.

Important Upcoming Dates

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Committee meeting</td>
<td>May 7</td>
<td>TRIUMF</td>
</tr>
<tr>
<td>Advisory Committee on TRIUMF</td>
<td>May 14-15</td>
<td>TRIUMF</td>
</tr>
<tr>
<td>Subatomic Experiments Evaluation Committee meeting</td>
<td>June 10-11</td>
<td>TRIUMF</td>
</tr>
<tr>
<td>Institute of Particle Physics AGM</td>
<td>June 12</td>
<td>Winnipeg</td>
</tr>
<tr>
<td>Canadian Association of Physicists Congress</td>
<td>June 13-15</td>
<td>Winnipeg</td>
</tr>
<tr>
<td>TRIUMF Board of Management meeting</td>
<td>June 18</td>
<td>TRIUMF</td>
</tr>
<tr>
<td>TRIUMF Summer Institute</td>
<td>July 5-16</td>
<td>TRIUMF</td>
</tr>
<tr>
<td>Molecular and Materials Science Experiment Evaluation Committee meeting</td>
<td>July 5-6</td>
<td>TRIUMF</td>
</tr>
<tr>
<td>Nuclei in the Cosmos Conference</td>
<td>July 19-23</td>
<td>Vancouver</td>
</tr>
<tr>
<td>Form 180 - Intention to apply for grants</td>
<td>&lt; August 15</td>
<td>Ottawa</td>
</tr>
<tr>
<td>Fifth International Symposium on Radiohalogens</td>
<td>September 11-15</td>
<td>Whistler</td>
</tr>
<tr>
<td>Major grant applications due to TRIUMF Science office</td>
<td>September 22</td>
<td>TRIUMF</td>
</tr>
<tr>
<td>TRIUMF Board of Management meeting</td>
<td>September 26</td>
<td>TRIUMF</td>
</tr>
<tr>
<td>Major grant applications due (RT3, &gt;500k$ ...)</td>
<td>October 1</td>
<td>Ottawa</td>
</tr>
</tbody>
</table>

Outreach Program Turns One

The TRIUMF Outreach Program (TOP) began one year ago to coordinate all aspects of science education and public outreach at TRIUMF. Working with external outreach-related groups, TOP has made good progress towards building comprehensive and coherent educational opportunities for the public, students, teachers, through to undergraduate and graduate students. To date, the successful Teacher Internship Program (see Newsletter Vol.1, No.2) has hosted seven teachers from across BC on local experiments, with 12 more on the waiting list, and discussions are underway with a Vancouver college to provide interns academic credit. A new Web site and a much revamped tour brochure are in progress. TOP has partnered with BC Science World in the Scientists in the Schools program, and with the ISCBC on a new High School Fellowship. Participation in the NALTA cosmic-ray on schools project will begin this summer.

Funding is provided by the Vancouver Foundation and the TRIUMF Tech Transfer office, before being incorporated into the next five-year plan in 2005.

Marcello Pavan
For more information on Outreach Program initiatives, contact outreach@triumf.ca

Contact Information:

- Director: A. Shotter  director@triumf.ca
- Assoc. Director/Science: J.M. Poutissou  sciencediv@triumf.ca
- Accelerator Technology: E. Blackmore  acceldiv@triumf.ca
- ISAC Division: P. Schmor  isacdiv@triumf.ca
- Cyclotron Operations: R. Poirier  cldadmin@triumf.ca
- Technology Transfer: P. Gardner  techtrans@triumf.ca
- Financial Officer: S. Reeve  finance@triumf.ca
- Human Resources: J. Hanlon  admin@triumf.ca
- Education Outreach: M. M. Pavan  outreach@triumf.ca

TRIUMF is Canada’s national laboratory for particle and nuclear physics and related sciences. TRIUMF is operated through a contribution from the National Research Council of Canada.

Operated as a joint venture by:
- University of Alberta
- University of British Columbia
- Carleton University
- Simon Fraser University
- University of Victoria

Associate Members:
- University of Guelph
- University of Manitoba
- McMaster University
- Université de Montréal
- Queens University
- University of Regina
- University of Toronto

The TRIUMF Newsletter is published bi-annually. For an HTML version and subscription: www.triumf.info/public/news/newsletters.php
Send any Newsletter queries or comments to: newsletter@triumf.ca
Proposal Submissions
to the Experiments Evaluation Committees

We are inviting users to submit new proposals related to research at ISAC, or other TRIUMF Beam facilities.

All proposals should include:
- A concise summary of the scientific problem under investigation, with appropriate literature references
- A clear justification for the proposed experiment
- A description of the experimental techniques to be used and naming the facilities to be used
- An analysis of beam time requirements
- An indication of how the personnel effort is to be devoted to this experiment

Proposals are requested and received from individuals and groups around the world and are judged solely on the basis of scientific merit and feasibility by the Experiments Evaluation Committees (EEC), peer review boards constituted of distinguished scientists from all over the globe. Proposal forms are available online at:
http://admin.triumf.ca/docs/forms/eec_blank.pdf.

There are three independent Committees (EEC) for the TRIUMF cyclotron and/or ISAC:
- Subatomic physics experiments (SAPEEC)
- Molecular and materials science experiments (MMSEEC)
- Life sciences experiments (LSPEC)

Each of these committees advises TRIUMF’s Director of its recommended priorities in the allocation of beam time and major facilities. The Director is not bound by the EEC’s recommendations, but has never ignored them.

During the review, proposals are assigned a priority rating that assists in the scheduling of the experiment. The EEC convenes to hear formal proposals once or twice a year. The next meetings are scheduled as follows:

The Eighth International Symposium on Nuclei in the Cosmos

July 19-23, 2004
Vancouver, BC, Canada

The 8th International Symposium on Nuclei in the Cosmos is the foremost bi-annual get together of theoretical and observational astrophysicists, nuclear physicists, cosmochemists, and others interested in the creation of energy and elements in the universe. It features a wide interdisciplinary scope with ample discussions among the participants. Topics include, among others:
- Cosmology and Big Bang Nucleosynthesis
- Stellar Evolution
- Experimental and Theoretical Nuclear Astrophysics
- Dynamics of Stellar Explosions
- Isotopic Anomalies in Meteorites
- Observational Evidence of Nucleosynthesis
- High Energy Astronomy
- Stars as Laboratories

Registration now open!

Important deadlines:
- April 2, 2004: Submission of abstracts
- April 18, 2004: Early registration fee ends
- April 18, 2004: Early booking fees at hotel end
- June 17, 2004: Guest room block released at hotel
- July 19, 2004: Beginning of conference and deadline for submissions to proceedings

For more details, visit: www.triumf.ca/nic8

For information on exhibitors and exhibiting, please contact Phil Gardner at gardner@triumf.ca

For information regarding registration, accommodation and NIC logistics, please contact:
Elly Driessen, Conference Coordinator, email: nic8@triumf.ca
TRIUMF, 4004 Wesbrook Mall, phone: +1 604 222 7352
Vancouver, BC, Canada, V6T 2A3 fax: +1 604 222 1074

International Advising Committee:
Marcel Arnould Belgium
Richard Boyd USA
Lothar Buchmann Canada
Roland Diehl Germany
Robert Gallino Italy
David Hanna Canada
Wick Haxton USA
Wolfgang Hillebrandt Germany
Taka Kajino Japan
Shiguru Kubono Japan
Karlheinz Langanke Denmark
Hamish Lesley Canada
Weiping Liu China
Grant Mathews USA
John Norris Australia
Michael Pearson Canada
Nicholas Prantzos France
Harvey Richer Canada
Claus Rolfs Germany
Alan Shotter Canada
Isao Tanihata Japan
Michael Wiescher USA
Stan Woosley USA
The TRIUMF Summer Institute (TSI) is designed to give graduate students and young researchers an improved understanding of topics surrounding their research areas by providing short courses in subatomic physics. This year’s Institute will focus on selected nuclear astrophysics research topics both from a theoretical as well as an experimental point of view. Related topics in astronomy and nuclear physics will be presented as well. Lectures will take place in the mornings, while afternoons are reserved for problem sessions. University credit can be arranged. TSI 2004 will give an excellent introduction to the eighth symposium on Nuclei in the Cosmos which will take place the week after in Vancouver, B.C. Both experimental and theoretical physics students are urged to attend. Participation is normally limited to 40 students.

For more details, visit: www.triumf.ca/tsi

For information regarding registration, accommodation and TSI logistics, please contact:
Elly Driessen, TSI 2004, TRIUMF, 4004 Wesbrook Mall, Vancouver, BC, Canada, V6T 2A3
email: tsi04@triumf.ca
phone: +1 604 222 7352
fax: +1 604 222 1074