Subatomic Physics Evaluation Section
Annual Report

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I. Introduction

This report summarizes the activities of the Subatomic Physics (SAP) Evaluation Section (SAPES) in fiscal year 2015-16, including the results of the March 2016 competition. The report is provided for information to the NSERC Committee on Grants and Scholarships, and to the Canadian subatomic physics community. The format and content of the report follow the reports from previous years very closely.

The Subatomic Physics Evaluation Section is a standing review committee that oversees a suite of programs. Funding for the Subatomic Physics suite of programs has been made through an independent envelope mechanism since 1991. Individual, Team and Project Discovery, Research Tools and Instruments (RTI), and Major Resources Support (MRS) grant applications in subatomic physics are evaluated together by SAPES. This comprehensive approach is essential given the complexity and inter-dependency of many proposals, which are often and ever-more frequently parts of international programs and collaborations, and involve many universities and national laboratories. This approach is also essential for planning and stability of execution of large-scale and long-term projects, and for maintaining a balance between large projects and the smaller research efforts that are essential to the breadth and future success of the Canadian SAP program. The envelope structure also helps SAPES maintain as appropriate a balance between operations and capital investments as possible. Moreover, the SAP community's five-year Long-Range Plan includes the community's priorities, and provides guidance to SAPES' deliberations. The most recent Long-Range Plan was produced in 2011 and covered the period 2011-2016. The next Long-Range Plan process is currently underway, and will cover the period 2017-2021 with a look ahead to 2026. The corresponding report will be available in fall 2016, for the 2017 competition.

Another unique strength of SAPES is the extent to which it solicits reviews by international experts of the highest calibre. All major Team, Project, RTI and MRS grants are separately reviewed by *ad hoc* or standing committees of internationally-recognized experts drawn

from institutions from around the world. These committees perform exhaustive scientific, technical, and budgetary evaluations, and produce detailed written reports which provide exceptionally valuable input to SAPES for its assessment of the grant applications. Moreover, SAPES generally selects a substantial proportion of international external reviewers for each proposal, from the smallest individual discovery grant to the largest project proposal. Finally, the membership of SAPES is itself substantially international, with half or more of its members generally coming from institutions in the U.S. and Europe. This level of international review provides an exceptionally high degree of scrutiny and validation of the research funded by this Evaluation Section.

In its report, *The State of Science and Technology in Canada, 2012*, the Council of Canadian Academies identified Nuclear and Particle Physics as one of the sub-fields in which Canada excels and leads the world in terms of scientific impact. Despite the internationally-recognized excellence of Canadian SAP research, and the unique strengths of the SAPES envelope structure and review processes, the past several years have been increasingly difficult for this Evaluation Section to financially support the community's short- and long-term objectives at an appropriate and competitive level to ensure the maximum scientific return on substantial investments already made. Specifically, the SAPES budget has been practically flat for the past seven years, while the number of full-time faculty has increased by more than 10% over the same time. Several high-priority research programs are in the ramping-up phase of their activities, while others are at the full scientific exploitation stage. The success of the subatomic community in securing infrastructure funding through CFI has also led to ever-increasing demands on the SAP envelope for operational funds.

Looking back ten years ago (a relatively small window over the typical timescale of SAP projects), the scenario of a flat envelope was thoroughly analyzed in the 2006 LRP report, with the conclusion that it would lead to a curtailing of research operating support and affect growth possibilities in Canadian SAP research activities. In such a scenario, it was recognized that the ability of the Canadian subatomic physics community to exploit the major capital investments of the past decade and to achieve its long-term scientific vision would be jeopardized.

The 2011 LRP report, *The Subatomic Universe: Canada in the Age of Discovery*, describes the constrained support provided to the "flagship research programs" over the past 5 years as they neared the stage of data-taking and science exploitation, with concurrent reductions from elsewhere in the envelope. The report warns that if this trend continues, funding for investment in equipment will suffer as a consequence of increasing needs from small and large projects in an era of decreasing budgets. This concern has proved prescient, as the increasing demands on operational funds have led to pressure on the ability of the envelope to support small-scale "seed funding" for equipment through the RTI program.

There is an urgent need to protect and exploit the considerable investments that have already been made in SAP research. One can justifiably state that the Canadian SAP program has become a victim of its own excellence and successes, and that the currently available operating funds are enough only to maintain existing activities at a constrained

level that is not always sufficient to allow Canadian researchers to contribute to the full extent of their potential. Clearly, the internationally-recognized excellence and contributions of the Canadian SAP community, coupled with the unique strengths of the SAPES envelope, ensure that additional investments in this area will yield exceptionally high returns in cutting-edge knowledge and the training of highly-qualified personnel (HQP). As stated in the 2011 LRP report, and demonstrated by the outcome of recent competitions, such additional investments are now more needed than ever if the Canadian SAP research program is to continue to produce excellent science both now and in the future.

II. Update on the Envelope Funding

The pressure on the Section's funding envelope has been building for several years; it has now reached a level that is difficult to manage. In particular, substantial investments by federal and provincial government funding agencies have annually injected non-operational funds into the SAP program in excess of 50% of the entire SAPES envelope, including substantial capital investments from CFI and various provincial government agencies. Other substantial investments by the Canadian government in science and technology, such as the Canada Research Chairs (CRC) program, have also resulted in a fast growth of the number and the quality of young faculty in SAP at many Canadian institutions. The latter increase has, in turn, been accompanied by a substantial growth in the number and quality of graduate students and other highly qualified personnel.

The SAP community has been very effective in making use of CFI's programs for major capital equipment. This additional source of funding is welcome, but it is important to highlight the fact that it is in turn generating further pressure on the envelope as the latter is the main funding source in support of research-related costs. Up until recently repeated attempts to foster the necessary level of coordination between CFI and NSERC had not succeeded. This year, SAPES Co-Chair Adam Ritz participated in a meeting of representatives of NSERC, CFI, and members of the Subatomic Physics Long-Range Plan Committee to discuss the issues and propose solutions. This is the start of ongoing interactions between the funding agencies. For the first time this year representatives from CFI presented at Large Project Day and attended all presentations made by collaborations throughout the afternoon. This was seen as a very positive sign and first step to establishing more contact between the peer review processes of NSERC and CFI. As stated in the last Long Range Plan (2011-2016), without such coordination there is a risk for research funding to be spread too thin, leading to failure of major parts of the Canadian subatomic physics program. An alternative risk would be for research funding to be focused only on a few state-of-the-art major infrastructures, leaving several others unexploited.

Since the 2006 Long-Range Plan was released, new funds were allocated to NSERC by the federal government in Canada's annual budgets, but were mostly provided for clearly targeted priority areas which did not include SAP. In *Budget 2011*, NSERC received $15M to "support outstanding research in the natural sciences and engineering fields, such as the Strategy for Partnerships and Innovation (SPI)." NSERC devoted half of those funds to

enhance the support given to Early Career Researchers (ECRs) across all disciplines in the form of supplements to their Discovery grants. ECRs with active grants in subatomic physics have received such supplements. Even though this is a welcome development, it has translated into a limited influx of funds into the envelope ($125k). In *Budget 2014*, NSERC received an additional $15M "to support advanced research in the natural sciences and engineering". These funds are being phased into the Discovery grants program over the five-year cycle, with approximately $3M being added to the budget each year starting in 2014-2015. The share of $3M being added to the subatomic physics envelope is approximately $158k. Given that much of the spending in the subatomic physics envelope is directed toward Project Grants of three-year duration, the funds will be phased in over a three year period, with the addition of $474k in FY 2015, $632k in FY 2016 and $790k in FY2017. On March 22 of this year the Government announced $30M of "new annual funding for discovery research" in Budget 2016. At this time it is not known what impact this will have on the Subatomic Physics Envelope. As a reminder, the 2011-16 LRP report recommends an injection of $2.5M into the envelope to restore R&D funding and an additional $1M to further support flagship projects to fully reap the rewards of previous investments.

III. Evaluation Section

This year's SAPES comprised 11 members, including three theorists. Three new members joined for full three-year terms and two returning members joined for one-year terms. Our new members were Karsten Heeger (Yale University), Heather Logan (Carleton University), Gabriel Martinez Pinedo (Technische Universität Darmstadt) and our alumni were Georges Azuelos (Unversité de Montréal, TRIUMF) and Greg Landsberg (Brown Unviersity). The full SAPES membership is given below.

Name	**Organization**	**Final Year**
Georges Azuelos	Université de Montréal, TRIUMF	(2016)
Yorick Blumenfeld (Co-Chair)	Institut de physique nucléaire d'Orsay	(2016)
Karsten Heeger	Yale University	(2018)
Greg Landsberg	Brown University	(2016)
Heather Logan	Carleton University	(2018)
Augusto Macchiavelli	Lawrence Berkeley National Laboratory	(2016)
Naomi Makins	University of Illinois at Urbana-Champaign	(2017)
Gabriel Martinez Pinedo	Technische Universität Darmstadt	(2018)
Mark Messier	Indiana University	(2016)
Adam Ritz (Co-Chair)	University of Victoria	(2017)
Neil Spooner	University of Sheffield	(2016)

The Co-Chairs would like to acknowledge the very demanding task faced by SAPES members throughout the year, up to and especially through competition week. Very long hours of deliberations ensured that each proposal was fairly and consistently evaluated

according to the selection criteria. The remarkable professionalism and dedication of SAPES members is manifest in the high quality of the Section's recommendations. The Co-Chairs also wish to sincerely thank SAPES members for their careful and constructive attitude throughout the competition, and for ensuring the conduct of our many discussions in a pleasant atmosphere. Special thanks also go to this year's retiring members, Yorick Blumenfeld, Augusto Macchiavelli, Mark Messier, and Neil Spooner for three years of outstanding service to the Canadian SAP community; it is deeply appreciated. As well, many thanks go to returning members Georges Azuelos and Greg Landsberg who agreed to contribute their experience and expertise to the deliberations this year when commitments prevented others from participating.

It is a pleasure for the Co-Chairs to thank NSERC staff for their expert guidance and help in the months leading up to the competition, and during the many long days of competition week: Shashini Jayaratne (Program Assistant), Kim Bonnet and Michèle Takoff (Program Officers), Sarah Overington (Team Leader), Elizabeth Boston (Director, Mathematical, Environmental and Physical Sciences), and Pierre Charest (Vice-President, Research Grants and Scholarships).

IV. Orientation/Policy Meeting and Information Visits

Each year, SAPES launches its operations during an orientation and policy meeting. This is a critical opportunity for the new members to familiarize themselves with NSERC and SAPES operating procedures, to be informed of the process leading to competition week, and to interact with the returning members. News from NSERC, including a detailed review of the competition budget, is also communicated to the members. The orientation and policy meeting for this competition was held on November 3, 2016 via teleconference. Given ongoing budgetary constraints, this is the fourth year this meeting is held entirely via teleconference.

Until the 2011 competition, it had been a tradition, following the policy meeting, for SAPES to visit Canadian institutions with subatomic physics research programs on a 3-year rotation basis. The visits were conducted for informational purposes only and were not a part of the grant evaluation process. They provided opportunities to communicate information about NSERC and the review process to researchers, while the Section members heard presentations about the researchers' activities and learned first-hand about their infrastructure and environment. The learning process that accompanied these visits was particularly important considering the large number of SAPES members affiliated with non-Canadian research institutions, in addition to the variety of sub-disciplines covered by the envelope. These visits were also a valuable opportunity for Canadian members to get a full sense of the research environments of their colleagues from one end of the country to the other over their three years of service on SAPES.

Since the 2011 competition, owing to operating budget pressures at NSERC, these information visits are no longer held. With these discontinued visits and the now fully tele-conferenced orientation meeting, competition week is the first and only time per year that Section members meet. This is viewed by members of SAPES, and indeed much of the

SAP community, as a negative development. The benefits to the review process that leads to multimillion funding recommendations completely justify the relatively modest costs involved in the information visits. The Section appreciates the budgetary constraints under which NSERC is operating. The Section strongly recommends, however, that NSERC considers reinstating these visits.

Again this year SAPES members were given the CINP-IPP jointly prepared document on the context of the Canadian research environment, with the opportunity to ask questions. This document was originally prepared in response to the CINP's and the IPP's request (echoed in previous SAPES Annual Reports) to reinstate the discontinued SAPES fall site visits, given their value to both national and international members of the Evaluation Section in understanding the Canadian research context and environment. The document provides an overview of the roles that various Canadian funding agencies play in supporting subatomic physics research and provides details about Canadian subatomic physics research institutes. The document further provides information about the structure and different options for Canadian M.Sc. and Ph.D. programs, followed by details about the regional differences in the training of Highly Qualified Personnel (HQP). An Appendix listing the typical level of graduate student support at different Canadian universities across the country is included as well.

This year a second pre-competition teleconference was again held just prior to competition week in order to remind the members of NSERC's policies and guidelines, and present the most up-to-date budget for the competition. Up to competition 2012, such a session used to be held right at the start of competition week. This pre-competition session is seen as very useful and should continue to be part of the yearly lead-up to competition week.

V. Pre-Review Process

The review of the Notifications of Intent to Apply (NOI) for a Subatomic Discovery Grant took place in September. Subatomic Physics Discovery applications which require NOIs include Individual, Team, Project, MRS, Category-2 and Category-3 RIT grant applications.

The review of Individual NOIs involved all the Section Chairs of the Physics Evaluation Group, including the SAPES Chair, and the Physics Group Chair. Its objective was to discuss those applications whose research topics crossed the boundaries of two or more Sections within the Physics Evaluation Group or related to a discipline other than physics. For each application, the intent was to identify the Section (or Evaluation Group, if the research topic related to another discipline) that should take the lead for the review and determine the need to provide or receive expert input to/from other Evaluation Groups. In the case of SAPES, which operates in a standalone mode with a separate membership, the need to provide or receive expert input was primarily related to the other Sections of the Physics Evaluation Group.

As a result of this process, one application submitted to the Subatomic Physics Evaluation Section was transferred to the Physics Evaluation Group, as well, five applications which were submitted to the Physics Evaluation Group in error were transferred to the Subatomic Physics Evaluation Section Moreover, for two Subatomic Physics grant applications, members from the Physics Evaluation Group, with relevant expertise, were asked to participate in the deliberations during competition week. Likewise, members of SAPES participated in the review of two Discovery grant applications in other Sections of the Physics Evaluation Group.

When the Notifications of Intent to Apply for a Subatomic Physics Discovery Category-2 or Category-3 RTI or MRS grants are received, NSERC in consultation with the Co-Chairs assigns each application first and second internal reviewers who are SAPES members with the most appropriate expertise, and with careful consideration of balancing the full workload among all of the members. Additionally, a third reviewer is systematically assigned, with special responsibility for budget scrutiny, for Discovery or MRS grant applications that request funds averaging $500k/year or more. Likewise, a third internal reviewer is systematically assigned to Category-3 RTI grant applications.

In the case of Discovery grant applications, the first reviewer is required to recommend five external reviewers for each of his/her assigned proposals. Typically, up to two of the external reviewers could be chosen from the list of suggested reviewers on the Notification of Intent to Apply. It is in the applicant's interest to suggest reviewers who are not in conflict of interest according to NSERC's guidelines. Internal reviewers generally recommend a substantial fraction of external reviewers who are from outside Canada. This year an average of 3.1 external reviewer reports per Discovery grant application were received.

Similarly, once Category-1 RTI grant applications are received, NSERC in consultation with the Co-Chairs assigns first and second internal reviewers to each of them. External reviewer reports are not typically sought for RTI grant applications.

VI. *Ad hoc* Expert Review Committees

Ad hoc expert reviews are typically held for Discovery grant applications requesting more than an average of $1M per year or for Category-3 RTI grant applications. In this year's competition, five *ad hoc* expert reviews were conducted prior to the competition, in fall 2015/winter 2016, and one SAPES member was present for each of them. These reviews were related to the standing review and Category-3 RTI grant application submitted by ATLAS-Canada, the Discovery Project and Category-1 RTI grant applications submitted by the Canadian Belle II Collaboration, the Discovery Project grant application submitted by SNO+, the Discovery Project grant application submitted by DEAP-3600, and the Subatomic Physics Major Resources Support grant application submitted by the Institute of Particle Physics. The ATLAS-Canada standing review was held through a series of teleconferences, as was the Belle II review. The DEAP-3600 and SNO+ reviews were held through face-to-face meetings in Ottawa on November 5-6 and November 7-8, 2015,

respectively. The IPP MRS review was held through a face-to-face meeting in Vancouver on January 11-12, 2016.

The reviews were carried out by *ad hoc* or standing Committees of experts. Full reports with recommendations, including budget recommendations when applicable, were prepared for SAPES. The reports, without the budget recommendations, are sent by NSERC to the applicants prior to Large Project Day. The reports *with* the budget recommendations are sent to the applicants after the results of the competition are announced.

Moreover, the Co-Chair Adam Ritz attended the meetings of the Advisory Committee on TRIUMF (ACOT) held on October 4-6, 2015, and on April 22-23, 2016.

VII. Large Project Day

It has proved extremely useful to devote one day prior to the beginning of the competition to hearing presentations by applicants of Discovery and MRS grant applications typically requesting an average of $500k per year or more, besides applicants of Category-2 or Category-3 RTI grant proposals. This is referred to as Large Project Day (LPD). These large proposals are typically complex, with extensive budgets, international commitments and project planning timelines which go far beyond those of smaller scale grant applications. The success or failure of a scientific program can depend on factors beyond the control of the Canadian research team. There have been notable examples in recent years in which the funding decisions in a host country forced changes in the scientific direction of the Canadian team between time of grant submission and assessment by SAPES. The opportunity to question the projects in writing and in-person in advance of the SAPES deliberations is critical to a thorough evaluation and a judicious recommendation to NSERC.

The focus of LPD is to meet with representatives of large Canadian projects. However, it is also now customary to meet on LPD with management representatives from the Canadian Institute of Nuclear Physics (CINP), the Institute of Particle Physics (IPP), the Perimeter Institute, SNOLAB, and TRIUMF. In addition, this year SAPES also heard from the Chair of the Long Range Plan Committee as well as representatives from Canada Foundation for Innovation (CFI). LPD was held this year in Ottawa on Sunday, March 6, 2016. The agenda is attached as Appendix 1.

The day began with *in camera* presentations from representatives of Canadian institutes; Cliff Burgess (McMaster University, Perimeter Institute) presented on behalf of Perimeter Institute, followed by Nigel Smith (Director, SNOLAB) and Reiner Kruecken (Deputy Director, TRIUMF). The morning continued with an *in camera* presentation by Michael Roney (Director, IPP), open presentation with Dean Karlen (Chair of the Long Range Plan Committee 2017-2027), and in camera presentation by Guy Levesque (CFI). They provided the Section with the perspective of the communities served by their organizations and answered questions previously submitted by the Evaluation Section. Applicants then made presentations and answered the questions of the Evaluation Section; this was done in an

open session that was attended by all primary applicants in attendance. The invited grant proposals were, in order of presentation, the projects Belle-II, Ultra Cold Neutrons at TRIUMF, ATLAS, SNO+, PICO, and DEAP-3600.

VIII. Beginning of the Competition

The funds available to the Section at the beginning of the competition are shown in Table 1.

There were $33k available from 2015 carried over into this year's competition budget, due to adjustments on ongoing installments.

Taking into account on-going commitments from previous competitions, $7.4M was available for the 2016 competition (32% of the envelope). This year, SAPES received 58 applications. At the start of competition, the total funds requested for fiscal year 2016 amounted to $14.9M. Consequently, at that point in the competition, the projected average funding rate for fiscal year 2016 was 50%. For comparison, the funding rates for the years 2007 to 2015 were 55%, 66%, 66%, 46% (57% without SNOLAB operations), 61%, 69%, 53%, 52%, and 64% respectively.

SUBATOMIC PHYSICS ENVELOPE
MULTI-YEAR COMMITMENTS BY CATEGORY
Beginning of 2016 Competition

	2015	2016	2017	2018	2019
RTI - COMMITTED	$285,285	$85,000	$35,000	$0	$0
RTI - NEW (2016 Competition)	$0	$0	$0	$0	$0
RTI - TOTAL	**$285,285**	**$85,000**	**$35,000**	**$0**	**$0**
THEORY - COMMITTED	$3,409,706	$2,692,800	$2,096,300	$1,413,100	$949,100
THEORY - NEW (2016 Competition)	$0	$0	$0	$0	$0
THEORY - TOTAL	**$3,409,706**	**$2,692,800**	**$2,096,300**	**$1,413,100**	**$949,100**
EXP OPS** - COMMITTED	$17,050,470	$12,607,370	$7,830,120	$261,370	$144,957
EXP OPS - NEW (2016 Competition)	$0	$0	$0	$0	$0
EXP OPS - TOTAL	**$17,050,470**	**$12,607,370**	**$7,830,120**	**$261,370**	**$144,957**
MRS - COMMITTED	$2,389,444	$596,207	$484,173	$46,000	$48,000
MRS - NEW (2016 Competition)	$0	$0	$0	$0	$0
MRS - TOTAL	**$2,389,444**	**$596,207**	**$484,173**	**$46,000**	**$48,000**
TOTAL - COMMITTED	$23,134,905	$15,981,377	*$10,445,593*	*$1,720,470*	*$1,142,057*
TOTAL - NEW (2016 Competition)	$0	$0	$0	$0	$0
GRAND TOTAL	**$23,134,905**	**$15,981,377**	**$10,445,593**	**$1,720,470**	**$1,142,057**
TOTAL ENVELOPE	**$23,190,811**	**$23,351,331**	**$23,509,251**	**$23,509,251**	**$23,509,251**
REIMBURSEMENT - FORWARD BORROW FROM PAST COMPETITIONS	**-$22,931**	**$32,975**	**$0**	**$0**	**$0**
CARRY FORWARD FROM FY2015 / AVAILABLE	***$32,975***	**$7,402,929**	**$13,063,658**	**$21,788,781**	**$22,367,194**

Table 1. Overall budget available at the beginning of the 2016 competition.

IX. The 2016 Competition

On Thursday, March 3, 2016, the Section held a teleconference in order to prepare for the competition. During this teleconference, members were reminded of policies and procedures, and the competition budget was presented.

The competition was held in Ottawa over a period of five days, from Monday, March 7 to Friday, March 11, 2016. The first day started with a review of the logistics. The Evaluation Section then started Round 1 of the competition, and proceeded with the review of the applications.

The format of the discussions strictly followed NSERC's guidelines and SAPES internal procedures. Previously, in the fall of 2015, at least two SAPES members were assigned to conduct an *internal* review of each application. During competition week, for each application, the first internal reviewer presented all aspects of the proposal and made his/her recommendations (ratings, funding, duration). This was followed by additional comments and/or a presentation by the second internal reviewer, who also made recommendations. For grant applications requesting support in excess of an average of $500k per year, or for Category-3 RTI grant applications, a third presentation, concentrating on budget matters, was made. These in-depth assessments were carried out independently by the internal reviewers (who were not aware of the other's identity before the first reviewer's presentation), and took into account the reports received from external reviewers, if available, as well as reports from *ad hoc* expert committees where applicable. Each application was then thoroughly discussed by all SAPES members. At the end of the discussion, each member was asked to rate the application against NSERC's selection criteria: (i) excellence of the researcher(s), (ii) merit of the proposal, (iii) contributions to the training of Highly Qualified Personnel (HQP), and (iv) need for funds. SAPES then decided whether to recommend funding the application, the level of funding, and the funding duration. Any recommendation was determined through secret electronic voting. The median vote was selected as the final SAPES recommendation. Members in conflict with any particular application left the meeting room before the internal reviewers were identified and the application was discussed; they were never informed, even by the end of the competition, of the final result or of the identity of the internal reviewers.

The entire Section reviewed experimental Individual, Team, and Project Discovery grant applications as well as any Category-2 and Category-3 RTI proposals. The entire Section also reviewed Category-1 RTI proposals that were tied to large Project grant applications. Once these reviews were completed, SAPES members were divided into two Sub-Sections: Theory and RTI-1/MRS Sub-Sections. The Theory Sub-Section reviewed all the theory Individual grant applications. The RTI-1/MRS Sub-Section reviewed the Category-1 RTI grant requests (up to $150k requested in total) and MRS grants requesting < $500k per year.

As usual, SAPES members were asked not to keep a cumulative total of the recommended awards, in order not to bias the review of applications discussed towards the end, and to ensure that all applications were treated consistently and fairly.

Moreover, in order to ensure the integrity of the review process, applications could be flagged by any SAPES member, the Program Officer, or the Team Leader at any time in Round 1, if he/she felt that some aspects of the discussion or the recommendation necessitated further deliberations. Flagged applications are re-discussed before the budget balancing discussion that concludes the deliberations of Round 1.

The Round 1 deliberations concluded shortly after noon on Wednesday, March 9. The Team Leader made a presentation on the budget, taking into account the sum of the recommended awards for all the applications. The result was that a sum of $10.024M had been recommended from the envelope, to be compared to a total of $7.402M that was available to SAPES, and $14.902M in requested funds.

Prior to the start of Round 2, a thorough discussion took place to establish the guiding principles for the re-evaluation of all proposals in an attempt to balance the budget. The SAPES members were unanimous that the same set of principles would be applied to all proposals, that all proposals would again be assessed strictly on their merits, and that account would be taken of the Section's evaluations of the four criteria for each proposal, which had been recorded in Round 1. All applications were then re-visited and revised funding recommendations made, again using secret electronic vote. As in Round 1, any application could be flagged if someone felt that some aspects of the revised recommendation necessitated further deliberations.

The Round 2 deliberations concluded in the afternoon of Thursday, March 10. During the competition $117k in post-award adjustments was confirmed for the SAP envelope, bringing the available sum to $7.520M. The Team Leader presented the results: the revised recommendation by the Section was for $8.363M from the envelope, compared again with the available sum of $7.520M.

At that point, the SAPES members carefully reviewed the allocated funding for future years and the distribution of the recommended budget amongst the various categories of grant applications assessed within the envelope: research operating grants (Individual, Team and Project Discovery; MRS); Category-2 and Category-3 RTI grants; and Category-1 RTI grants. Round 3 was completed in three stages. The first was a review of all grants with recommended funding of more than $100K/year looking for any further efficiencies. The second stage was to reduce all other Individual, Team and Project Discovery grant recommendations by 5%. Finally in the third stage all multi-year awards were re-profiled by taking 10% of the award value from Year 1 and re-distributing it among the remaining years of the award. Care was taken to assess the impact of this allocation on the fraction of the envelope that would be available for distribution in future years. At the end of Round 3 the total recommendation for funds was $7.560M. The Section then agreed to forward borrow $40k from the 2017 competition.

With recommended total funding of $7.560M from the envelope, and a total request for $14.902M, the funding rate for this year's competition is 50%.

X. End of Competition Results

The Section's final multiyear budget, broken down into equipment, theory, experimental operating, and MRS allocations is shown in Table 2, while Table 3 gives the percentage share of the envelope in theory, equipment, and operations over the period from 2010 through 2016.

As forecast in the 2006 Long-Range Plan and confirmed in the 2011 Long-Range Plan, these figures provide quantitative measures of the funding crisis that continues to loom over the Canadian SAP community. The share of the envelope now committed to the support of research operations is at a record high, with little room for small-scale capital investments that are critical for emerging research endeavours.

Small-scale capital investments by SAPES, mostly for proposals that fall outside the mandate of the CFI, are needed for R&D efforts that are crucial for the future of Canadian SAP, and to satisfy the capital needs of the smaller programs that are essential to the breadth of the community. Due to the long cradle-to-grave time scale of subatomic physics research programs, some overlap between current and next-generation discovery endeavours is unavoidable if Canada is to continue to play a leading scientific role in next-generation forefront research projects. At a time when Canadian researchers are actively and fruitfully exploiting the public investments made to date in leading endeavours, it would not be opportune to consider re-allocating a substantial part of the support to these efforts towards small-scale capital investments.

XI. Recommendations to the DAS Program

This is the ninth year of the Discovery Accelerator Supplements (DAS) program. The present objective of this program is to provide substantial and timely additional resources to researchers who have a superior research program that is highly rated in terms of originality and innovation, and who show strong potential to become international leaders within their field. SAPES directly allocates one DAS award. During the regular deliberations for each Individual and Team Discovery grant application, SAPES members could put forward the applicant(s) after the deliberation and vote. Following the final round, once the competition budget is balanced, all the potential candidates are discussed in detail against the DAS selection criteria and objectives. Subsequently, the members rate each nomination according to how well it meets the objections of the program on a scale of 1 (very well) to 4 (No Support) through a secret vote, and the nominee(s) are selected by numerical tally of the Section's votes. This year, the Section quota for DAS nominees was one (1), as in recent years.

The DAS program is not aimed at Project grant applications. As indicated in the 2009 annual report, a procedure is available for any member of a Collaboration submitting a Project grant application to be considered by SAPES for the DAS program; however this option has not been exercised to date.

XII. Policy Matters

At the end of the competition, the Evaluation Section and NSERC representatives came together for a session devoted to policy matters. Pierre Charest (Vice-President, Research Grants & Scholarships), and Elizabeth Boston (Director, Mathematical, Environmental and Physical Sciences) attended this session in whole or in part.

Members of SAPES were asked to give their feedback on the attempt this year to apply the current Conflict of Interest guidelines with a focus on actual conflicts as opposed to perceived conflicts. This approach was taken in an attempt to ensure the participation of Canadian members in the review of experimental applications. Again there was discussion of Conflict of Interest rules from other agencies. SAPES members commented on the importance of having Canadian experimentalists as members of the Section.

Other topics of discussion included: the role of Expert Review Committees, which are highly valued by the Section; the application content and how the formatting of these documents could be improved; changes to the use of criteria in the evaluation of MRS applications; and meeting logistics.

Expert Reviews: SAPES recommended that the terms of reference for Expert Review Committees be amended to include an assessment of the budget which would take into account budget pressure faced by the SAP Envelope. For example, this could be through a general request for guidance on the impact of flat funding, or funding at the level of 50 and 70% of the request. As well, it was suggested that the threshold for these reviews be lowered, and/or triggered when smaller efforts are ramping up (for example requesting 25% increase over previous level of support).

Application Material: SAPES recommended a different configuration of the materials provided. As well, members suggested that a table with all co-applicants and the number of hours devoted to the research proposed within the application would be very useful in assessing the FTE effort across all applications.

MRS Criteria: SAPES recommended adapting the criteria to assess the Excellence of the Resource, rather than the Excellence of the Researchers named as co-applicants on the grant. Technical personnel are not as easy to assess as the applicants; to assess the impact the focus should be on the resource (those supported by the MRS).

SUBATOMIC PHYSICS ENVELOPE MULTI-YEAR COMMITMENTS BY CATEGORY Beginning of 2016 Competition					
	2016	2017	2018	2019	2020
RTI - COMMITTED	$85,000	$35,000	$0	$0	$0
RTI - NEW (2016 Competition)	$479,875	$0	$0	$0	$0
RTI - TOTAL	**$564,875**	**$35,000**	**$0**	**$0**	**$0**
THEORY - COMMITTED	$2,692,800	$2,096,300	$1,413,100	$949,100	$0
THEORY - NEW (2016 Competition)	$592,515	$686,090	$686,090	$601,778	$601,778
THEORY - TOTAL	**$3,285,315**	**$2,782,390**	**$1,413,100**	**$1,550,878**	**$601,778**
EXP OPS** - COMMITTED	$12,547,370	$7,830,120	$261,370	$144,957	$0
EXP OPS - NEW (2016 Competition)	$4,747,175	$2,742,371	$2,645,471	$380,541	$380,541
EXP OPS - TOTAL	**$17,294,545**	**$10,572,491**	**$2,906,841**	**$525,498**	**$380,541**
MRS - COMMITTED	$539,000	$484,173	$46,000	$48,000	$0
MRS - NEW (2016 Competition)	$1,741,000	$1,741,000	$1,741,000	$0	$0
MRS - TOTAL	**$2,280,000**	**$2,225,173**	**$1,787,000**	**$48,000**	**$0**
TOTAL - COMMITTED	$15,864,170	$10,445,593	$1,720,470	$1,142,057	$0
TOTAL - NEW (2016 Competition)	$7,560,565	$5,169,461	$5,072,561	$982,319	$982,319
GRAND TOTAL	**$23,424,735**	**$15,615,054**	**$6,793,031**	**$2,124,376**	**$982,319**
TOTAL ENVELOPE	**$23,351,331**	**$23,509,251**	**$23,509,251**	**$23,509,251**	**$23,509,251**
REIMBURSEMENT - FORWARD BORROW FROM PAST COMPETITIONS	**$32,975**	**$0**	**$0**	**$0**	**$0**
CARRY FORWARD FROM FY2015 / AVAILABLE	**-$40,429**	**$7,894,197**	**$16,716,220**	**$21,384,875**	**$22,526,932**

Table 2. Breakdown of multiyear commitments at the end of the 2016 competition.

Subatomic Physics Evaluation Section Evolution of Envelope's Shares							
	2016	2015	2014	2013	2012	2011	2010
Theory	14.1%	14.7%	14.0%	14.3%	14.2%	14.2%	14.2%
RTI	2.4%	1.2%	4.7%	2.7%	2.6%	5.5%	3.8%
Total Research Ops	83.8%	83.8%	81.4%	82.9%	83.3%	80.3%	82.0%
Exp. Ops	74.1%	73.5%	71.3%	72.8%	71.9%	67.7%	68.9%
MRS	9.8%	10.3%	10.1%	10.2%	11.3%	12.5%	13.0%

Table 3. Envelope share in theory, experimental operations, and equipment, from 2010 to 2016.

Appendix 1

SUBATOMIC PHYSICS EVALUATION SECTION - 2016 COMPETITION

LARGE PROJECT DAY

Sunday March 6, 2016
Constitutions Square
350 Albert Street, Ottawa, Ontario
Room 18-125

8:00 – 8:30	***Committee meets in camera***	
8:30 – 8:50	Meeting with Perimeter Institute – *in camera*	C. *Burgess*
8:50 – 9:20	Meeting with SNOLAB – *in camera*	*N. Smith*
9:20 – 9:50	Meeting with TRIUMF – *in camera*	*R. Kruecken*
9:50 – 10:10	Meeting with CINP – *in camera*	*G. Huber*
10:10 – 10:25	***Coffee Break***	
10:25 – 11:10	Meeting with IPP – *in camera*	*M. Roney*
11:10 – 11:40	Meeting with Chair of Long Range Plan Committee	*D. Karlen*
11:40 – 12:00	Meeting with CFI – *in camera*	*G. Levesque*
12:00 – 12:45	***Lunch***	
12:45 – 13:20	The Belle-II Experiment	*C. Hearty*
	Beam Background Monitors for Belle-II Experiment	
13:20 – 13:55	Ultra Cold Neutrons at TRIUMF	*J. Martin*
13:55 – 14:30	Upgrading the ATLAS Detector at the LHC	*P. Krieger*
14:30 – 14:50	***Coffee Break***	
14:50 – 15:35	SNO+ Data Taking and Operations: Years 1-2	*M. Chen*
15:35 – 16:10	Search for Dark Matter with PICO	A. *Noble*
16:10 – 16:55	DEAP-3600 Operation and Analysis	*M. Boulay*
17:00	***Committee meets in camera***	

Presentation Time Requirements:	15 min. presentations: 10 min. for presentation and 5 min. for Q&A 20 min. presentations: 15 min. for presentation and 5 min. for Q&A 30 min. presentations: 15 min. for presentation and 15 min. for Q&A 35 min. presentations: 20 min. for presentation and 15 min. for Q&A 45 min. presentations: 25 min. for presentation and 20 min. for Q&A