

ISOLDE AND NEUTRON TIME-OF-FLIGHT  
EXPERIMENTS COMMITTEE

Minutes of the 33<sup>rd</sup> meeting of the INTC  
Held on Monday 16 and Tuesday 17 February 2009

**OPEN SESSION**

Monday 16 February 2009 at 13:30 h, Council Chamber

The Chairman of the INTC, Mark Huysse, opened the meeting and informed the Committee on the upcoming workshop on the future non-LHC experiments to be held at CERN May 11-13, 2009. He emphasized that it is very important to have contributions for the session dedicated to the ISOLDE Physics programme. He then announced that for this meeting he will be the last time Chairman of the INTC Committee and that Peter Butler will take over afterwards.

**ISOLDE Technical Report**

The EN-representative for the INTC, Mats Lindroos (now affiliated with EN-STI-RBS), summarized the technical activities during the shutdown period 2008/2009. The intense maintenance work concentrates on the improvement of the target area, general work in the ISOLDE hall, and repairs of the REX-ISOLDE system. Mats Lindroos especially thanked Erwin Siesling for coordinating all shutdown work and Alexandre Dorsival from the Radioprotection group, who needs to be present for most of the interventions.

In the target area the cameras were improved and new neon lights as well as security lights were installed to improve visibility for future interventions. In addition, the robots for target handling were checked and repaired. Further maintenance in the target area comprised removal of old target units, general safety checks, intervention of the ventilation and cooling systems, as well as work on the front ends including new cables for new turbo pumps to be mounted in the future. Due to a frequent breakdown of compressed air tubes throughout the ISOLDE facility it was decided to exchange all 400 meters during this shutdown period. The repair of many broken scanners and wire grids is planned to ensure operational beam diagnostics for the upcoming running period. Furthermore, the vacuum system of the RFQ cooler and buncher ISCOOL is being integrated into the existing ISOLDE control system to ensure safe operation.

For REX-ISOLDE a new shielding tunnel which is made of concrete blocks is being constructed. This will further limit the X-ray exposure in the experimental hall as well as improve the future maintenance work, e.g., on the 9-gap resonator since the lead shielding can be permanently removed afterwards. The removal of the lead shielding and the end-closure installation will follow in the next shutdown period 2009/2010. Further ion-beam optics was repaired and a new tilted foil mechanism has been developed and will be installed behind the RFQ structure of REX before the start of operation in 2009. General REX maintenance included

the work on power supplies for magnets, REXEBIS, REXTRAP, vacuum system, controls, applications and beam diagnostics.

The Committee was informed of the delivery of the first batch of 35 targets that were constructed under a new contract with Alca in Italy. As a highlight from target development the successful improvement of an arc discharge ion source was presented (VADIS). Recent tests showed an increase of up to a factor 10 in ionization efficiency for noble gases. It is planned to use this upgrade for all plasma targets in 2009.

Finally, an overview of the present status of the HIE-ISOLDE project was given, which focuses on three main objectives. In the first work package, the energy upgrade of REX-ISOLDE is foreseen in 3 steps, starting with 5.5MeV/u, then 10MeV/u, and finally the increase of the low-energy capacity. The second work package is related to the intensity upgrade with improvements of the PS Booster, basically faster cycling, and the LINAC4 construction. This will require new target stations for ISOLDE, new targets and a new target handling system in order to accommodate the higher intensities and dose rates. With the help of a 3D laser scan of the target area, the required changes of the target area can be planned much more precisely. The third work package focuses on the improvement of beam quality, which was partly achieved with the installation of the new ISCOOL RFQ buncher and cooler as well as the RILIS upgrade including the off-line LARIS lab, funded with major contributions from Sweden and UK. It is planned to upgrade the charge breeder, to improve the mass resolution and to continue the target and ion source development. The Committee was informed of the possible layout of the new HIE-LINAC and the required installation of a cryo-plant for the delivery of liquid helium to the new superconducting cavities. Mats Lindroos concluded the report with an overview of the external contributions to HIE-ISOLDE and submitted and planned proposals. The discussion with CERN management on the contribution of CERN to the HIE-ISOLDE project is ongoing.

## **ISOLDE Physics Report**

The ISOLDE Physics Coordinator, Alexander Herlert, summarized the running period 2008 by presenting the RIB shift distribution and trends of ISOLDE operation over the last years. The CERN accelerator schedule of 2008 comprised 27 weeks (191 days) of on-line physics runs at ISOLDE with protons from the PS Booster from May 5 until November 12. Overall, it was a very successful running period. A few of the many results obtained in 2008 are charge-radii measurements on the one-proton halo nucleus  $^{11}\text{Be}$  with COLLAPS, on-line emission channelling experiments on  $^{61}\text{Co}$ , in-vivo experiments with radioactive Hg isotopes, the first two-neutron transfer reaction with a  $^{30}\text{Mg}$  beam at MINIBALL, and the first observation of a new isotope of radon,  $^{229}\text{Rn}$ , with the Penning trap mass spectrometer ISOLTRAP.

For the 2008 on-line schedule in total 551 RIB shifts were requested by 46 ISOLDE experiments from which 358 RIB shifts could be scheduled for 31 experiments (some with more than one beam). Additional shifts were reserved for target and ion-source development as well as machine development for REX-ISOLDE. For the new ISCOOL RFQ cooler and buncher an additional day for the setup of each target was added to the HRS schedule. After a difficult start of the running period, as was reported in the last meeting, most of the experiments in 2008 were successful and some used for the first time the bunched beam from the ISCOOL device. Most of the technical problems were related to vacuum problems (especially the GPS line was partly running in manual mode), broken scanners and wire grids, and a polluted extraction electrode after molten metal targets and thus frequent tripping of the high voltage. Several power cuts hampered the setup of some runs, however, there was no significant loss of shifts. The few broken target units could be replaced with backup units and there was no major loss of shifts for physics runs. The limitation of the proton beam intensity for the GPS could be removed after

further tests and the new RILIS pump laser was in operation for the whole running period and showed a good performance (only in a few cases the copper vapour lasers had to be used).

In total 25 target units were used in 2008, with 4 old units from past years, 15 uranium carbide targets (2 old units), and one thorium oxide target for a target test. Overall that target showed a good performance and just for a few runs the yields were lower than expected. In two cases no results could be obtained as no neutron-rich Au and Hg beams could be delivered. This needs to be investigated in the future.

From the PS Booster  $5.16 \times 10^{19}$  protons were delivered to ISOLDE, about  $3 \times 10^{19}$  on the HRS targets and  $2 \times 10^{19}$  on the GPS targets. This amounts to 318.5 RIB shifts that were delivered in 2008 with 247 RIB shifts (77.6%) for INTC experiments and 71.5 RIB shifts (22.4%) for target and ion source developments, target tests, REX MD and other tests. The RIB shift distribution is as follows: Biology and medicine 3.3%, particle and astrophysics 4.7%, experiments using atomic physics techniques 12.9%, solid state physics 8.8%, weak interaction and nuclear physics 45.1%, target and ion source development and REX MD 15.4%, and the Coordinator's reserve 7.1%. The average of 1.7 RIB shifts per day is similar to the number of past years. As in 2007, the request for uranium carbide targets and RILIS operation was very high. Again more than 68% of the RIB shifts were taken with UC targets and the RILIS was operated for more than 2000 hours (including off-line tests and set up). 20 ISOLDE experiments made use of the selective RILIS ionization with 145.5 RIB shifts for INTC experiments, which is about 60% of all INTC RIB shifts. The new RILIS pump lasers were used for most of the runs. Elements addressed with RILIS schemes were: Nd, Ga, Be, Cd, Tl, Mn, Au, Cu, Mg, and Pb.

For REX-ISOLDE 104 RIB shifts were delivered to 7 REX experiments (6 RIB shifts for development, e.g. mass resolution tests and pulsed injection into the EBIS), which are 42% of all INTC RIB shifts, continuing the trend of an increasing number of RIB shifts for REX experiments over the last years. New elements and isotopes post-accelerated are:  $^{10}\text{C}^{3+}$ ,  $^{61}\text{Fe}^{21+}$ ,  $^{61,62}\text{Mn}^{15+,21+}$ , and  $^{202,204}\text{Rn}^{47+}$ .

The schedule for the CERN accelerator complex for 2009, as approved by the Research Board on December 5, 2008, foresees a running period of about 31 weeks for ISOLDE, starting on April 14, 2009 (stop of protons November 23, 2009).

The following proposals and addenda were then presented:

1. **CERN-INTC-2009-003 and INTC-P-254**, *Ground-state properties of K-isotopes from laser and  $\beta$ -NMR spectroscopy*, Gerda Neyens
2. **CERN-INTC-2009-004 and INTC-P-255**, *Coulomb Excitation of  $^{94,96}\text{Kr}$  beam - Deformation in the neutron rich Krypton isotopes*, Dennis Mucher
3. **CERN-INTC-2009-005 and INTC-P-229-ADD-1**, *Magnetic dipole moments of high-K isomeric states in Hf isotopes*, Nick Stone
4. **CERN-INTC-2009-006 and INTC-P-237-ADD-1**, *First results from IS468 and further investigation of in-trap decay of  $^{62}\text{Mn}$* , Jarno van de Walle
5. **CERN-INTC-2009-007 and INTC-P-256**, *Crystal field investigations of rare earth doped wide band gap semiconductors*, Ulrich Vetter
6. **CERN-INTC-2009-009 and INTC-P-257**, *Study of oblate nuclear shapes and shape coexistence in neutron-deficient rare earth isotopes*, Andreas Gorgen
7. **CERN-INTC-2009-010 and INTC-P-258**, *Study of Local Correlations of Magnetic and Multiferroic Compounds*, Joao Pedro Araujo
8. **CERN-INTC-2009-011 and INTC-P-259**, *Ag(I), Pb(II) and Hg(II) binding to biomolecules studied by Perturbed Angular Correlation of  $\gamma$ -rays (PAC) spectroscopy: Function and toxicity of metal ions in biological systems*, Lars Hemmingsen
9. **CERN-INTC-2009-012 and INTC-P-260**, *Measurements of competing structures in neutron-deficient Pb isotopes by employing Coulomb excitation*, Tuomas Grahn
10. **CERN-INTC-2009-013 and INTC-P-261**, *Radiotracer diffusion in semiconductors and metallic compounds using short-lived isotopes*, Manfred Deicher
11. **CERN-INTC-2009-014 and INTC-P-262**, *Coulomb Excitation of  $^{72}\text{Zn}$  - Vibrational Proton-Neutron Structure of the Even-A Z=30 Isotopic Chain*, Dennis Mucher
12. **CERN-INTC-2009-016 and INTC-P-263**, *Masses of noble gases*, David Lunney
13. **CERN-INTC-2009-017 and INTC-P-264**, *Probing the N=50 shell gap near  $^{78}\text{Ni}$* , Riccardo Orlandi
14. **CERN-INTC-2009-018 and INTC-P-265**, *Defects in ZnO, CdTe, and Si: Optical, structural, and electrical characterization*, Manfred Deicher
15. **CERN-INTC-2009-019 and INTC-P-266**, *Nuclear structure studies of the neutron-rich Rubidium isotopes using Coulomb excitation*, Georgi Georgiev
16. **CERN-INTC-2009-020 and INTC-P-267**, *High-precision mass measurements below  $^{48}\text{Ca}$  and in the rare-earth region to investigate the proton-neutron interaction*, Magdalena Kowalska

## **CLOSED SESSION**

Tuesday 17 February 2009 at 8:30 h, room 60-6-002

**Present:** J. Billowes, Y. Blumenfeld, P. Butler, M. Doser, P.-H. Heenen, A. Herlert (Secretary), M. Huyse (Chairman), H. Leeb, M. Lindroos, N. Orr, P. Roussel Chomaz, V. Vlachoudis, U. Wahl

**Apologies:** M. Fanciulli, R. Julin, Ch. Scheidenberger

### **1. INTRODUCTORY REMARKS**

The Chairman opened the meeting and welcomed all Committee members. Michael Doser thanked Mark Huyse, also in the name of the Director for Research and Scientific Computing, Sergio Bertolucci, for chairing the INTC meetings in the last years and wished his successor Peter Butler all the best for the upcoming meetings.

Mark Huyse continued with a report on the announcement of the new Director General that a workshop on the non-LHC programme at CERN is planned for May 11-13, 2009 (for further details see web page: <http://indico.cern.ch/event/51128>). Also ISOLDE and nTOF will be presented at this workshop and it is foreseen to have dedicated talks on the present facilities and future projects as well as theoretical talks. Very important are contributions of the user communities, especially from young researchers, in order to show the future interest. The call for contributions has been announced recently and abstracts can be submitted via the web page given above. It was also pointed out that being present at the workshop will also signal the interest in the research programmes at ISOLDE and nTOF.

The Chairman reminded all Committee members on the procedure, that the sole criterion for recommending RIB shifts is that the proposal should contain a unique and well founded physics case. The number of RIB shifts might be reduced and discussed, taking into account recent yield information and radioprotection or other safety issues. The priority or ordering of experiments is not to be discussed at the INTC.

### **2. MINUTES OF THE LAST INTC MEETING**

The minutes of the 32<sup>nd</sup> INTC meeting held on 3 and 4 November 2008 were approved without amendments.

### **3. STATUS OF ISOLDE**

It was pointed out that the fraction of about 25% of RIB shifts delivered at ISOLDE for, e.g., target tests and beam development, is similar to the numbers in past years. The possible backlog of shifts will be discussed in the next meeting as all beam-time requests for 2009 will be available.

### **4. DISCUSSION ON THE OPEN SESSION AND ON LETTERS OF INTENT**

The proposals presented during the open session as well as submitted letters of intent were then discussed:

**CERN-INTC-2009-003/P-254**, *Ground-state properties of K-isotopes from laser and  $\beta$ -NMR spectroscopy*

The proposal aims to investigate the evolution of the effective  $\pi_{s_{1/2}}$  and  $\pi_{d_{3/2}}$  single-particle energies beyond N=28. It is planned to measure the hyperfine structure of neutron-rich potassium isotopes,  $^{48-51}\text{K}$ , using two measurement techniques: high-resolution laser

spectroscopy and  $\beta$ -NMR spectroscopy. Beyond  $N=28$  several theoretical predictions are available, but the systematic behaviour is not known and experimental data are required. The Committee regarded the physics motivation of interest and it is expected that the optical measurements with the bunched beams from the ISCOOL RFQ cooler and buncher will work very well. The magnetic moments can be determined and the ground-state spins assigned. For a firm spin assignment of  $^{48}\text{K}$  a second run with the  $\beta$ -NMR setup is needed. As pointed out, also the case of  $^{50}\text{K}$  is unclear, as it may have a nuclear spin  $I=0$ . For  $\beta$ -NMR measurements the cases of  $^{49}\text{K}$  and  $^{51}\text{K}$  are problematic due to the large  $\beta$ -n branch of their decay. In addition, the case of  $^{51}\text{K}$  seems rather difficult due to the low production yield. The Committee suggested to concentrate on the determination of the magnetic moments and **recommended** for approval by the Research Board **12 shifts** for the first experimental part covering the laser spectroscopy experiments and first tests with  $\beta$ -NMR spectroscopy. The proponents are asked to submit a status report after reviewing the results from the first on-line run in order to request the remainder of the proposed experimental programme.

**CERN-INTC-2009-004/P-255**, *Coulomb Excitation of  $^{94,96}\text{Kr}$  beam - Deformation in the neutron rich Krypton isotopes*

The experiment proposes to perform Coulomb excitation measurements on neutron-rich  $^{94,96}\text{Kr}$  isotopes using the MINIBALL gamma array at REX-ISOLDE. The investigation aims to study the shape change and deformation of neutron-rich Kr isotopes. The Committee found the physics case of interest and expects a rapid change of the structure for  $N=58-60$ . The number of counts required to derive a meaningful  $B(E2)$  value for  $^{96}\text{Kr}$  was poorly justified and it was felt that a statistics some 2/3 of that estimated in the proposal was sufficient. The Committee thus decided to reduce the number of requested shifts and to **recommend** for approval by the Research Board **12 shifts**.

**CERN-INTC-2009-005/P-229-ADD-1**, *Magnetic dipole moments of high-K isomeric states in Hf isotopes*

This addendum to the proposal P229 asks for a continuation of the investigation of the magnetic dipole moments of high-K isomeric states in Hf isotopes. The users had performed experiments in 2008 at the NICOLE on-line nuclear orientation setup. The initially planned measurement programme was hampered by technical problems; however, valuable data were recorded for  $^{177}\text{Hf}$ . The Committee took note of the presented solutions of the encountered problems and was convinced that many of these are under control. It is expected that in the requested additional shifts new results can be obtained to complete the measurement programme. It was stressed that the combination of the  $\text{HfF}_3$  beams available at ISOLDE and the NICOLE facility makes the proposed experiments unique. The Committee therefore **recommended** for the approval by the Research Board **15 shifts** and asked the Physics Coordinator to combine if possible with other runs to allow for an efficient change of samples in the NICOLE cryostat, for which up to 2 shifts are needed.

**CERN-INTC-2009-006/P-237-ADD-1**, *First results from IS468 and further investigation of in-trap decay of  $^{62}\text{Mn}$*

In this addendum additional on-line shifts are requested to continue the investigation of the in-trap decay method at REX-ISOLDE in order to provide Fe beams, e.g., for Coulomb excitation experiments at MINIBALL. In 2008 the decay of  $^{61}\text{Mn}$  into its daughter  $^{61}\text{Fe}$  was studied under controlled conditions in REX-TRAP and REX-EBIS. The users could successfully post-

accelerate  $^{61}\text{Fe}$  for the first time and obtained results from Coulomb excitation measurements. Although it was expected that the  $^{61}\text{Fe}$  ions should be stored after the decay of  $^{61}\text{Mn}$  in REX-TRAP, no daughter ions were observed after charge-breeding and post-acceleration;  $^{61}\text{Fe}$  could only be efficiently produced and stored during the charge-breeding time in REX-EBIS. Further investigations are needed and the users would like to extend their studies to  $^{62}\text{Mn}$  and  $^{62}\text{Fe}$ . The Committee found the physics motivation and the technical development of high interest and thus **recommended** for approval by the Research Board **9 shifts** to further explore the production and post-acceleration of Fe beams.

**CERN-INTC-2009-007/P-256**, *Crystal field investigations of rare earth doped wide band gap semiconductors*

The proposal is directed towards crystal field investigations of wide band gap semiconductors doped with rare earth isotopes. It is planned to employ a new perturbed  $\gamma\gamma$  angular correlation setup which is based on digital signal processing instead of the usually used analogue systems. The Committee found the physics motivation sound and accepted that the proposed new experimental setup would be capable of allowing a complex analysis of the results. The Committee decided to **recommend** for approval by the Research Board **14 shifts** for a period of two years.

**CERN-INTC-2009-009/P-257**, *Study of oblate nuclear shapes and shape coexistence in neutron-deficient rare earth isotopes*

The aim of the proposed experiment is to study the shapes of neutron-deficient rare earth isotopes with Coulex experiments at REX-ISOLDE employing the MINIBALL system. The Committee found the physics case well presented but at first glance not very exciting as these nuclei are thought to represent soft rotors or vibrators. However, the predicted shape changes in the very narrow region of nuclei near  $N=78$  and  $Z=62$  are interesting and should be verified. This would also be a stringent test of the theoretical model used.  $B(E2)$  values for transitions from  $2^+_{1,2}$  and  $4^+_1$  levels could be determined, too, and low-lying  $0^+$  states may be observed, which could give information on the predicted shape coexistence. Two measurements are proposed, one for  $^{140}\text{Sm}$  and the other for  $^{142}\text{Gd}$ . The RILIS schemes are available but have not been tested, i.e., more beam development is needed for the proposed experiments. The given rate estimates are sound, however, 21 shifts seem sufficient. The Committee **endorsed** the physics case and requested a Letter of Clarification which addresses the issue of contamination suppression needed and tests of RILIS schemes before recommendation for approval by the Research Board.

**CERN-INTC-2009-010/P-258**, *Study of Local Correlations of Magnetic and Multiferroic Compounds*

This proposal is a continuation of the scientific programme of the same group/collaboration. It covers three main topics for which mainly the perturbed angular correlation method will be employed. All subjects discussed are up to date and the physics case is very interesting. The Committee took note on the experimental data obtained in the last years and the resulting publications. The envisaged experimental programme is very ambitious with many subjects and even more nuclides. The Committee therefore decided to **recommend** for approval by the Research Board **25 shifts** for the next two years and encourages the submission of an addendum afterwards.

**CERN-INTC-2009-011/P-259**, *Ag(I), Pb(II) and Hg(II) binding to biomolecules studied by Perturbed Angular Correlation of  $\gamma$ -rays (PAC) spectroscopy: Function and toxicity of metal ions in biological systems*

The presented proposal aims to investigate the toxicity and function of metal ions in biological systems. It is planned to use radioactive Ag, Hg and Pb isotopes to study metallothioneins, de novo designed proteins, and protein folding as well as to perform in vivo studies. The users want to employ a 6-detector-TDPAC perturbed angular correlation setup for their experiments. Although it found it difficult to judge the physics case, the Committee found that the envisaged biophysics experiments would be a very good addition to the ISOLDE programme. The group has obtained very good results and wants to continue its investigations at ISOLDE. The proposed number of shifts seems reasonable and the Committee decided to **recommend** for approval by the Research Board **21 shifts** for a two-year programme and reminded that only plants and not animals should be subject of the in vivo studies.

**CERN-INTC-2009-012/P-260**, *Measurements of competing structures in neutron-deficient Pb isotopes by employing Coulomb excitation*

This proposal is a resubmission of the proposal P246. It is planned to use the MINIBALL gamma array to study competing structures in neutron-deficient Pb isotopes performing Coulomb excitation experiments. The Committee found the physics motivation much sounder as compared to the previous proposal. It was pointed out that new information can be retrieved from a complicated spectrum of  $^{188}\text{Pb}$ , however,  $^{190,192}\text{Pb}$  are maybe easier to address. Nevertheless, the Committee was not yet convinced on the experimental determination of the beam composition, as it is expected that the beam purity is about 80%. Thus the Committee decided to **endorse** the physics case, but requested a Letter of Clarification to address the question of how and with what precision the beam composition can be monitored online.

**CERN-INTC-2009-013/P-261**, *Radiotracer diffusion in semiconductors and metallic compounds using short-lived isotopes*

The proposed experimental programme is a continuation of the investigation of the diffusion of short-lived nuclides in semiconductors and metallic compounds as pursued by the same group in the last years. These are well established experiments with very good results and the Committee took note of the new experimental setup dedicated for in-situ diffusion studies at ISOLDE. While the physics case is of interest and worthwhile to be studied, the Committee expressed concern that the presentation did not justify the large number of requested shifts. The Committee **recommended** for approval by the Research Board **10 shifts** for nuclides with half-lives suitable for standard diffusion experiments. A status report was requested for the new on-line setup after installation and first in-situ measurements before further on-line shifts can be recommended for nuclides with half-lives of a few minutes. The Committee pointed out, that for a future addendum of this programme the beam request should be made clearer and also a priority should be assigned to the different physics topics and corresponding nuclides.

**CERN-INTC-2009-014/P-262**, *Coulomb Excitation of  $^{72}\text{Zn}$  - Vibrational Proton-Neutron Structure of the Even-A Z=30 Isotopic Chain*

The aim of the proposed experiment is to measure low-lying multi-photon excitations in  $^{72}\text{Zn}$ . It is planned to employ the MINIBALL gamma array for Coulomb excitation experiments. The Committee was not convinced that the measurements will enable one to distinguish between the cases  $\delta=0$  and  $\delta=1$  of the multipole mixing ratio. It was stressed that the proposed experiment is

at the edge of what is possible and that before addressing  $^{72}\text{Zn}$ , the stable nuclide  $^{70}\text{Zn}$  should be investigated to demonstrate that the technique is viable. It was also pointed out that the physics case for the investigation of  $^{94,96}\text{Kr}$ , as proposed by the same group, is more compelling. The Committee thus decided not to endorse the physics case and suggested to test the feasibility with stable  $^{70}\text{Zn}$  beam before a new proposal is submitted which clearly address the points raised.

#### **CERN-INTC-2009-016/P-263**, *Masses of noble gases*

With this proposal it is planned to determine the masses of exotic noble gas isotopes with the Penning trap mass spectrometer ISOLTRAP. The Committee found the envisaged measurement programme of interest, particularly for the Ar and Kr isotopes. With the recently developed VADIS arc discharge ion source higher ionization efficiencies can be achieved and very exotic nuclides are within reach. The ISOLTRAP experiment has shown its ability to address very short-lived nuclides also for production yields below 1000 ions/  $\mu\text{C}$  and therefore it seems feasible to obtain valuable data for neutron-rich Ar and Kr isotopes as well as neutron-deficient Kr isotopes. The Committee decided to **recommend** for approval by the Research Board **28 shifts** to address the Ar and Kr cases.

#### **CERN-INTC-2009-017/P-264**, *Probing the $N=50$ shell gap near $^{78}\text{Ni}$*

In the proposed experiment it is planned to explore the persistence of the  $N=50$  shell gap near the doubly magic  $^{78}\text{Ni}$  nuclide with (d,p) reactions on  $^{78}\text{Zn}$  isotopes using a  $\text{C}_2\text{D}_4$  target. The MINIBALL experiment will be used for gamma detection and the so-called T-REX silicon detector array will be coupled to the MINIBALL gamma array for the detection of the protons. The Committee found the physics case very interesting and strong but the experiment rather difficult with respect to the separation of the  $1/2^+$  and the  $5/2^+$  states. It was pointed out that the lifetime of the  $1/2^+$  state might be too long to be observed with MINIBALL. The Committee **recommended** for approval by the Research Board **27 shifts** including 3 shifts for the determination of the proper target thickness. In addition, the Committee suggested that test measurements of a known (d,p) reaction with a stable beam (preferably a Zn isotope) be performed prior to the run.

#### **CERN-INTC-2009-018/P-265**, *Defects in ZnO, CdTe, and Si: Optical, structural, and electrical characterization*

The aim of the proposed experiment is to study the properties of a number of technologically and fundamentally relevant defects in II-VI compound semiconductors and Si. It is planned to apply different experimental methods, e.g. perturbed  $\gamma\gamma$  angular correlation, deep level transient spectroscopy or photoluminescence spectroscopy, which are all available at ISOLDE and have been successfully applied in the past. The Committee found the physics case of interest but the number of requested shifts problematic. It was decided to **recommend** for approval by the Research Board **15 shifts** with the priority to the requested Ag beams. Furthermore, the Committee requested information on the influence of the recoil energy on the measurements and how to quantify its effect. As in the case of the proposal P261 a more detailed beam request with defined priorities is expected for a future addendum.

#### **CERN-INTC-2009-019/P-266**, *Nuclear structure studies of the neutron-rich Rubidium isotopes using Coulomb excitation*

The proposed experiment is directed towards the investigation of excited states in odd-mass neutron-rich Rb isotopes. It is planned to employ the MINIBALL gamma array for Coulex

experiments which can provide new data. Excited states are only known up to  $^{93}\text{Rb}$  and a sudden change from spherical to deformed nuclei should be verified in Rb isotopes also by following the systematics of excited states. The Committee found the physics case of high interest and regarded the modelling of the envisaged mass region as theoretically challenging. Further experimental data can shed new light on the systematic behaviour of the excited states and it was thus decided to **recommend** for approval by the Research Board **21 shifts**.

**CERN-INTC-2009-020/P-267**, *High-precision mass measurements below  $^{48}\text{Ca}$  and in the rare-earth region to investigate the proton-neutron interaction*

The proposal intends to investigate the proton-neutron interaction and its role in nuclear structure using precision mass measurements with ISOLTRAP.

The Committee felt that the physics case was far too wide ranging and as such was not clearly motivated. The Committee was also concerned by the interpretation of the  $\delta V_{pn}$  values over a broad region of the nuclear chart. The Committee decided not endorse the proposal and suggested that any future proposal must be better focused and should include reference to other theoretical models. Nevertheless, the Committee took note on the request for beam development on S beams and on rare earth beams and supported further tests of new RILIS schemes and of techniques to suppress contamination coming from surface ionization. The Committee suggested that a new proposal should be presented once the new beams are available. It was also pointed out that the requested Hf beam might be provided in connection with the proposal P229-ADD-1, subject to the Coordinator's discretion.

**CERN-INTC-2009-001/I-080**, *Collection of Rb-83 at low implantation energy for KATRIN*

This Letter of Intent aims at collecting  $^{83}\text{Rb}$  at ISOLDE in order to produce a source of short-lived  $^{83\text{m}}\text{Kr}$  for the KATRIN experiment, which is dedicated to the determination of the mass of the anti-neutrino. The  $^{83\text{m}}\text{Kr}$  isomer delivers mono-energetic electrons of 17.8 keV energy which are close enough to the endpoint energy of tritium and thus suitable for calibration purposes. In order to retain the Kr isotopes after implantation and decay of  $^{83}\text{Rb}$ , the substrate material has to be chosen and tested. Also the implantation energy needs to be checked as it influences the depth of implantation and emitted electrons may lose energy on the way out. The Committee **endorsed** the Letter of Intent and asked the Physics coordinator to schedule the requested on-line shifts - if feasible - in order to make the test collections. The Committee requested a full proposal if the tests are successful and further collections will be needed.

**CERN-INTC-2009-002/I-081**, *Radioactive probe studies of coordination mechanisms of heavy metal ions from natural waters to functionalized magnetic nanoparticles*

With this Letter of Intent it is planned to initiate investigations on the properties of magnetic nanoparticles with respect to their ability to absorb heavy metals from aqueous solutions. Isotopes of the elements Hg, Cd, and Pb will be implanted in solidified water which already contains the nanoparticles or to which they can be added later on. This is an established procedure at ISOLDE, already in use for the present biophysics experiments (e.g. IS448). The Committee regarded this idea as a new line of research and **endorsed** the Letter of Intent and asked the Physics coordinator to provide 2 shifts of radioactive beam for the envisaged tests subject to availability and the possibility to combine them with already approved experiments.

**CERN-INTC-2009-008/I-082**, *Measurement of  $^{163}\text{Ho}$  electron capture spectrum: detector test*

This Letter of Intent is directed towards a precision measurement of the  $^{163}\text{Ho}$  electron capture spectrum, which can provide a mass value of the electron neutrino if combined with precision mass measurements of the mother and daughter nuclide. It is planned to deposit  $^{163}\text{Ho}$  isotopes directly onto micro-structured detectors or onto thin gold foils which can be glued on a detector afterwards. The Committee found the physics case of interest, however, it was pointed out that recent implantation tests at ISOLDE showed a large amount of contamination in the delivered beam which poses a risk for the envisaged activity of  $^{163}\text{Ho}$  to be collected. The Committee did not endorse the Letter of Intent and suggested to find alternative ways (possibly at other facilities) to prepare a pure  $^{163}\text{Ho}$  sample and to deposit it onto the detectors.

**CERN-INTC-2009-015/I-083**, *Tilted-foils polarization at REX-ISOLDE*

With this Letter of Intent a new line of research is being initiated. By using tilted foils and accelerated beams from REX-ISOLDE, it is planned to polarize radioactive nuclides and to use a  $\beta$ -NMR setup for the detection afterwards. Tilted foils polarization has already been applied at ISOLDE, but was not continued in the last years. The proposed project makes use of the available infrastructure of REX-ISOLDE and the fact that an established  $\beta$ -NMR setup of the HMI Berlin was moved to ISOLDE last year. It is planned to prepare polarized beams at lower energy (300keV) and higher energies (about 2MeV/u) and to test the feasibility of detection and the loss of polarization. The Committee found the physics case of high interest and **endorsed** the Letter of Intent. The Physics Coordinator was asked to provide stable and radioactive beam - if available - to perform the planned tests.

Out of the **363** radioactive beam shifts requested to the INTC a total of **206** have been recommended for approval by the Research Board (on-line shifts for Letters of Intent are not included in these numbers).

## **5. DATES OF NEXT MEETING**

The next INTC meeting will take place on **Monday 18 and Tuesday 19 May 2009**. The deadline for submission of proposals is **Monday 20 April 2009**.

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