

ISOLDE AND NEUTRON TIME-OF-FLIGHT
EXPERIMENTS COMMITTEE

Minutes of the eighteenth Meeting
held on November 24th, 2003

OPEN SESSION

The Chairman, Juha Äystö, opened the meeting and announced the agenda. He noted that the meeting was the last before the arrival of the new management, and took the opportunity to thank the outgoing Research Director, Claude Détraz, highlighting his important role in making the programme at ISOLDE and nTOF successful. He furthermore expressed his thanks to the outgoing ISOLDE Scientific Coordinator Thomas Nilsson and pointed out his important contributions to the ISOLDE programme.

The ISOLDE Technical Coordinator, Mats Lindroos, recounted advances in the operation of the facility. The status of the integration of REX-ISOLDE into the AB division and the associated collaboration-financed posts was mentioned, as well as the new generation of front-ends recently taken into operation at the ISOLDE off-line separator. The status of the HRS front-end, where HV failures had prevented its use during most of 2003, was now satisfactory after a major overhaul and replacement of the cooling water tubes that had been found to be conducting.

The ISOLDE Scientific Coordinator presented the running statistics for the 2003 operational period. In total, 268 shifts of radioactive beam had been delivered to 27 approved experiments. This represents a clear decrease with respect to the 375 shifts in 2002, explained by the above-mentioned problems of the HRS, making push-pull mode operation impossible. However, the number corresponds closely to the delivered shifts in the period 1998-2001 when the shorter running period is taken into account, in spite of the augmented operation of REX-ISOLDE and the RILIS. This indicates that the thus increased complexity and failure rate has been successfully compensated by an enhanced reliability concerning the remaining parts of the facility. The backlog of approved shifts was discussed, currently amounting to 436 RIB shifts out of which the large majority of the shifts were approved within the last years. He then presented a number of highlights from the scientific programme and ended by thanking the ISOLDE and nTOF communities as well as all involved CERN groups for the excellent cooperation during his mandate.

Paolo Cennini, nTOF Technical Coordinator, described the 2003 operation of the facility. A total of $1.23 \cdot 10^{19}$ protons had been delivered, out of the $1.3 \cdot 10^{19}$ demanded. Furthermore, a number of modifications related to safety had been performed, e.g. displacing the control room outside the tunnel and fire protection measures. A new fission detector had been used where the active targets had been mounted and sealed at PSI since CERN does not yet have a

Class A radioactive laboratory. Several upgrade possibilities of the facility were shown, including exchanging the target cooling water by D₂O and additional shielding. The number of protons available for nTOF in 2004 was discussed. Michael Hauschild, the SPS/PS Coordinator injected that a similar amount as in 2003 was the maximum feasible without disrupting other users of proton beams at CERN. The Chairman pointed out the clear mismatch of this with respect to the $2.3 \cdot 10^{19}$ protons requested in P182.

The following proposals were then presented:

1. Radioactive Probes on Ferromagnetic Surfaces; INTC-2003-032/P179: H. Bertschat
2. Mn and Fe impurities in Si_{1-x}Ge_x alloys; INTC-2003-034/P180: G. Weyer
3. Measurement of the neutron capture cross section of ²³³U, ²³⁷Np, ^{240,242}Pu, ^{241,243}Am and ²⁴⁵Cm with a Total Absorption Calorimeter at nTOF; INTC-2003-036/P182: D. Cano-Ott
4. Lattice location of transition metals and rare earths in semiconductors; INTC-2003-037/P98 Add.2: U. Wahl
5. Nuclear Moments and Charge Radii of Magnesium Isotopes from N=8 up to (and beyond) N=20; INTC-2003-038/P183: G. Neyens
6. Exploring the shores of the "Island of Inversion": the structure of neutron-rich Al isotopes; INTC-2003-039/P185: T. Kröll

CLOSED SESSION

Present: J. Äystö (Chairman), P. Butler, T. Butz, P. Cennini, E. Chiaveri*, C. Détraz*, H. Doubre, M. Hauschild, D. Hilscher, M. Huyse, H.-J. Kluge, K. Langanke, M. Lewitowicz, M. Lindroos, T. Nilsson (Secretary), F. Priolo, H. Ravn, D. Schinzel, M. Streit-Bianchi (replacing J.A. Rubio), J. Suhonen, D. Warner

* Part-time

1. INTRODUCTION

The Chairman opened the session by welcoming Francesco Priolo, who had been absent the last meeting. The INTC matters at the 166th meeting of the Research Board were reported back to the Committee, including approval of the three recommended proposals and the status report from IS413. In connection with this, the importance of paying attention to the proposals themselves with respect to their quality and clarity in a general scientific context, in addition to a strong physics case, was underlined. The structure of the Scientific Committees following the forthcoming CERN reorganization was discussed; Claude Détraz explained that the structure to take recommendations to the management had not yet been decided upon.

The Chairman reminded the Committee Members of the ISOLDE Workshop to be held on December 15-17, and he recommended that they participate in order to become more informed about the scientific programme. He then reiterated that the meeting was the last within the mandate of Claude Détraz and conveyed thanks for his work, which had led to a very constructive cooperation between the Committee and the CERN Management. Claude Détraz replied gratefully that the Committee and the Associated Community had made an effort to communicate to the CERN Community at large, the importance of non high-energy physics science. The Chairman then again thanked Thomas Nilsson for his efficient and professional duties as Scientific Coordinator and Committee Secretary.

The minutes of the sixteenth meeting were approved with the following change to the last sentence of the paragraph on IS413 Status report: “expressed its wish that the mid-mass region be revisited” changed to “requested that the mid-mass region be revisited in accordance with the proposal”.

2. DISCUSSION ON THE DELIVERED SCIENTIFIC AND TECHNICAL REPORTS

ISOLDE Technical and Scientific report

The Committee commended the technical team regarding the facility performance within the current boundaries and **took note** of the development and imminent shutdown work. A discussion ensued on the accounting of radioactive beam time needed for commissioning and debugging REX-ISOLDE and the awareness of isobaric contaminants in the beam. The Committee took note of the transitional problems and **requested** that the time used to improve and better understand the device is documented appropriately. Claude Détraz commented that it was expected that substantial time and effort was thus needed concerning a device like REX-ISOLDE, which uses unique techniques. The importance of having prospective proponents contacting the ISOLDE in-house group on technical matters before submission was highlighted. Furthermore, the Committee **took note** with pleasure of the delivered scientific report and operational statistics. It **agreed** that the shift backlog was in a healthy state, but asked that the progress of experiments approved several years ago be monitored.

nTOF Technical report

The Committee **took note** of the report given in the Open Session and then considered the operational parameters for 2004. Michael Hauschild reported on the various approved projects that would be using protons in 2004 and, based on operational statistics, inferred a maximum of $1.6 \cdot 10^{19}$ protons to be delivered to nTOF. Any substantial increase of this number would mean drastic cuts in the intensity delivered to ISOLDE, LHC test beams and irradiations in the East Hall. Furthermore, it was pointed out that nTOF had exceptionally benefited from the unavailability of the HRS separator during 2003, prohibiting ISOLDE in periods from using the proton beam. Enrico Chiaveri addressed the specific situation concerning the EC contract and the PS stop in 2005; the measurements outstanding and covered within P182 belong to the deliverables and thus need to be performed in 2004. Dietrich Hilscher **drew attention** to the substantial increase in neutron flux within the most interesting energy region that could be attained by switching the target coolant to heavy water. Paolo Cennini replied that this modification was pending modifications due to safety but that a solution would hopefully be found.

3. DISCUSSION ON THE OPEN SESSION

The presentations of the new proposals made during the open meeting were then discussed.

P185 (INTC-2003-039): *Exploring the shores of the "Island of Inversion": the structure of neutron-rich Al isotopes*

This proposal concerns the "shore" of the so-called island-of-inversion region in light, neutron-rich nuclei. Here, ground state deformation is found around the magic number $N=20$, contradicting the shell model. The proponents planned to use REX-ISOLDE together with the MINIBALL Ge-detector array to populate states in $^{31,32}\text{Al}$ through single-particle transfer reactions and study the gamma rays emitted in coincidence with protons. The Committee considered the physics case highly interesting, but expressed concerns regarding the feasibility of the proposed measurements. The fact that both the initial and final states have a non-zero spin means that the transfer reaction is governed by a superposition of several j -values which, taken together with the lack of an angular distribution for protons, makes it difficult to see how any useful quantitative information on the structure of individual states can be extracted. Theoretical calculations by the Monte-Carlo Shell Model method could be of great help in the interpretation, but had not yet been performed for these systems. The Committee encouraged the proponents to supply more theoretical support but could **not approve** the project as now proposed.

P183 (INTC-2003-038): *Nuclear Moments and Charge Radii of Magnesium Isotopes from $N=8$ up to (and beyond) $N=20$*

This experiment aims at studying neutron-rich and -deficient magnesium isotopes and has a scientific motivation which was in part similar to the preceding proposal; the weakening of magic numbers in neutron-rich nuclei, however, here through studies of the ground state properties by collinear laser spectroscopy. The part of the proposal concerning neutron-deficient isotopes is pending development of new production targets whereas the part dealing with neutron-rich nuclei could be performed immediately, as shown in a recent test run by the group in question. The Committee regarded the proposal very positively, considering it to have potential to solve several outstanding issues concerning this region of the nuclear chart. It thus **recommended approval** of 35 shifts to address the case of neutron-rich isotopes, with a status report after the first year of data-taking. The importance of performing systematic along as long chains of isotopes as possible was pointed out by H.-J. Kluge. Thus, the proponents were **encouraged** to pursue the development of neutron-deficient Mg beams in conjunction with the in-house groups in view of extending the measurements.

P179 (INTC-2003-032): *Radioactive Probes on Ferromagnetic Surfaces*

The proposed project targets questions related to magnetic atoms on and in ferromagnetic surfaces, using radioactive probes. The Committee considered the proposed experiments highly interesting, adding a new degree of complexity to the earlier performed experiments. The competence of the group to study individual rare earth atoms on ferromagnetic surfaces is unique, without any competition. The Committee expressed some concern about interpreting some of the data from high-spin states in rare earth nuclei and the feasibility of the Mößbauer part of the measurements, but agreed however that the proposed measurements were of highest scientific standards. A request for an allocation of 22 shifts over a two-year period **will be made** to the Research Board.

P180 (INTC-2003-034): *Mn and Fe impurities in Si_{1-x}Ge_x alloys*

This proposal aims at studying the role of impurities in Si_{1-x}Ge_x alloys through Mößbauer spectroscopy. This material is poorly studied compared to pure Si and Ge in spite of its importance for applications in electronic devices. The Committee considered the experiments feasible, with an interesting physics case, but highlighted the even larger interest in studying SiGe under strain. However, the proposed measurements of unstrained bulk material were seen as a promising first step. The Committee thus **recommended** the approval of 8 shifts, pointing out that the requested ⁵⁷Fe probe was a unique feature of the ISOLDE facility.

P182 (INTC-2003-036): *Measurement of the neutron capture cross section of ²³³U, ²³⁷Np, ^{240,242}Pu, ^{241,243}Am and ²⁴⁵Cm with a Total Absorption Calorimeter at nTOF*

The project covers extensive measurements of key neutron capture cross sections at nTOF for accelerator-driven systems. The proposed measurements would complete the deliverables agreed upon in the contract of the nTOF collaboration with the EC. The motivation for the programme was considered sound, although the general validity of the statement of achieving an accuracy of 5% was questioned as well as the feasibility of measuring the fissile targets. In addition, the estimated number of protons needed to complete it during 2004 exceeded largely the intensities to be made available. The discussion then focussed on how to best accommodate the proposed measurements before the 2005 shutdown. The Technical Coordinator was urged to pursue the option of changing the target coolant to heavy water in order to increase the flux. The programme was **recommended for approval** by the Research Board, **pending** formulation of a practice to accommodate it within the existing boundaries for 2004. The priorities and the ordering of the measurements, performing the non-fissile targets before the fissile, should be revised by the concerned groups.

P98 Add. 2 (INTC-2003-037): *Lattice location of transition metals and rare earths in semiconductors*

The proposed measurements of lattice locations were seen as fundamental for understanding the role of impurities in semiconductors. The group is well experienced and equipped and have a good record of performing this kind of experiments, with publications that have had large impact. The current proposal was **positively** received by the Committee, but it **urged** the proponents to concentrate their efforts on the materials and impurities currently considered highly interesting, like studies of ZnO, GaNi and SiC. With this remark, the proposal will be **recommended** to the Research Board for an allocation of 10 shifts. Furthermore, the Committee pointed out the possible synergies between the proposed measurements and the studies achievable through an in-house photoluminescence apparatus. Unique information would be obtained by correlating the site information to the optoelectrical data. Marilena Streit-Bianchi pointed out that the proposed project might be of interest for ETT.

4. A.O.B.

I-049 (INTC-2003-033): *Studies of a Target System for a 4-MW, 24-GeV Proton Beam*

The authors of this letter of intent propose to perform proof-of-principle tests of a high-power production target station as needed for a Neutrino Factory or a Muon Collider. The target consists of a free mercury jet situated inside a 15T solenoid and would be installed in the nTOF tunnel. The Committee saw the tests as very useful, but questions regarding the implications for CERN and the nTOF scientific programme would have to be addressed in discussions with the concerned local groups, pending the outcome of an application to the EC. Furthermore, the major effort in machine development needed to deliver 8 PS bunches in one extraction cycle was highlighted. In conclusion, the Committee **welcomed** the physics case and **took note** of the current document.

Standing Group for the Upgrade of the ISOLDE Facility

Peter Butler, the Chair of the Standing Group, presented its mandate and composition. The group is in the short term concerned with upgrading the REX-ISOLDE post-accelerator to higher energy and to increase the intensities and number of radioactive beams available at ISOLDE. In a longer perspective, the group aims at preparing the facility for the planned new injector LINAC4 and later the SPL driver accelerator, seeking support for this in the relevant CERN Committees.

Meetings in 2004

The Committee agreed to change the meeting structure to move the open session to the afternoon, followed by the closed meeting in the subsequent morning, and to suspend the September meeting unless urgently needed. The next meeting will take place on **Monday February 23 - Tuesday February 24, 2004** and the deadline for submission of proposals is **Friday, January 23, 2004**.

The dates of the remaining INTC meetings in 2004 are:

24-25 May
20-21 September
15-16 November

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