

ISOLDE AND NEUTRON TIME OF FLIGHT
EXPERIMENTS COMMITTEE

Minutes of the twenty second Meeting of the INTC
Held on Monday 21 and Tuesday 22 February 2005

OPEN SESSION

Monday 21 February 2005 at 13:30 h, Council Chamber

The Chairman of the INTC, Juha Äystö, opened the meeting by stressing the importance of the year 2005 for ISOLDE, in view of the unique opportunity afforded by the fact that ISOLDE will be the only user of the PS Booster (PSB), and its impact for the ISOLDE community and its scientific production.

The ISOLDE Technical Coordinator, Mats Lindroos, reported on the technical activities at ISOLDE. He first reviewed the status of the REX-ISOLDE facility. The integration in the AB department is underway, the main shortcomings being the lack of technical support for the REX-ISOLDE low-energy stage and the additional workload for a small section of the AT/VAC group. The first stage of migration of the power supplies and control system to AB standards will be carried out in 2005, involving the AB/PO and AB/CO groups. The AB/BDI group has already been contacted to discuss the support for beam instrumentation. In 2005 the PC-based control system will be maintained by the AB/CO group via an industrial support contract. A project associate will join in spring 2005 to work on REX-ISOLDE instrumentation.

The REX-ISOLDE operation and maintenance was then discussed. The operation of the REX-LINAC is expected to become much more stable after a foreseen modification of the 200 MHz RF cavity. Furthermore, it will be possible to operate the REX-LINAC with a repetition rate of 100 Hz from July/August 2005, which can positively impact experiments with short-lived species. The major problem of peak staff needs during the setting-up and running of REX-ISOLDE remains for 2005. It is proposed to form a minimal supervisor team for 2005 and study a long term solution involving AB/OP group. Machine development time will be allocated in the schedule to allow for setting-up and for development of new beams.

He then reported on the progress of the ongoing shutdown activities at ISOLDE. The maintenance of the ventilation and cooling water system has been completed and work has been carried out in the optics of the ISOLDE beamlines. The latter includes the reconfiguration of the MISTRAL beam line and improvements of the HRS transmission by adding a new quadrupole. The radioactive *class A* laboratory for target manipulation will be completed in time for the 2005 run. Test of the new front end #6 have been started, it will be ready as a spare for the 2005 campaign. A grant has been received in the UK to fund the RFQ cooler project; the assembly and offline tests will be completed in 2005. The installation is foreseen for the 2005–2006 shutdown, provided the off-line tests are

satisfactory. In addition, there is an application in preparation in Sweden for funds to replace the copper vapour lasers of the RILIS by new pump lasers.

The operation of the facility in 2005 was then examined. An engineer in charge (EIC) will be on duty in the ISOLDE control room from 9:30 to 11:30 for all runs during the 2005 campaign and a new visible indication of the EIC on duty will be implemented. A work-package for support of the ISOLDE experimental area including REX-ISOLDE has been devised to account for the lack of support dating back to the fusion of the SL and PS divisions in January 2003.

The ISOLDE Scientific Coordinator, Luis M. Fraile, reported on the conditions for the 2005 schedule, with ISOLDE being the single user of the protons from the PSB. The approved accelerator schedule includes a 27 week period for physics at ISOLDE, from 25 April to 31 October. Twelve 4-hour time slots for access to the PS and six 8-hour periods for machine development at the PSB will be granted during the year. Furthermore, 2 out of 12 proton cycles will be used for parasitic machine development for the PSB once a week.

The reduction of the basic cycling period of the CERN accelerators and its impact on ISOLDE was then addressed. This has been presented by the High Intensity Proton beams working group at AB as a possible solution of the deficit of SPS cycles for fixed target physics and of the decreased performance of ISOLDE once CNGS starts operation. A new cycle of 900 ms has been devised as a short-term upgrade compatible with the current cycle structure and with the existing hardware and control system. This will immediately result in a 33% increase on the number of proton pulses for ISOLDE, but the equipment lifetime and radiation aspects should be monitored. The larger number of available cycles for ISOLDE will allow reducing the peak intensity and extend the target units lifetime.

The implementation of the 900 ms cycle was approved by the Management Board of the AB department on 06/12/04. The proposed approach consists of a test for the LINAC2 and PSB in 2005. The plan is to start at the standard 1200 ms cycling and prepare the 900 ms scheme in parallel. The switchover to 900 ms will be then carried out in one week of tests without any beam. In the following two weeks the proton beam would be delivered to ISOLDE with the new 900 ms cycle, and thus with higher intensity, but with risks of interruptions. An additional week without beam would be used to change over to 1200 ms again. A similar test scheme will be used in 2006 for the PS and SPS machines. The dates for the tests and implementation in 2005 are still to be defined by the PSB machine supervisor, and should avoid the LEIR commissioning starting 1 August and the summer period. The most likely period are weeks 21 to 24. The immediate impact for ISOLDE on the present campaign will be a reduced operation time to 25 weeks, with 2 more weeks with risk of interruptions. Under these conditions a maximum of 300 radioactive beam shifts can be scheduled. There are 579 outstanding shifts from previous approvals, out of which 212 are for REX-ISOLDE physics.

Other boundary conditions were then pointed out, and in particular the increased demand on the RILIS at ISOLDE, which exceeds the restriction of 150 physics shifts per year. This renders the RILIS equipment and manpower situation extremely critical for the success of the facility; the experimental groups were asked to contribute to the RILIS operation in any possible way. Other limitations include the number of uranium carbide targets that can be produced by the AB/ATB/IF group, and the REX-ISOLDE operation and the scheduled migration of REX-ISOLDE power supply controls (2 weeks). One further constraint has been released, namely the presence of the Miniball detector at ISOLDE. According to the schedule of transfer of MINIBALL from GSI to CERN decided by the Miniball steering

Committee on 11 February 2005, the move will start on 20 April and Miniball will be ready for experiments at ISOLDE on 20 May 2005. The schedule will be fixed as soon as all requests are received and the plan for the implementation of the 900 ms scheme is decided.

Finally some practical issues were discussed, including the ISOLDE shutdown courses for users that were held at end of 2004, and were overbooked, and the works on the extension of the ISOLDE hall, which are on schedule. The dust barrier protecting the experimental hall will be kept until mid April to allow for electrical installations and painting on the new extension.

The following proposals and status reports were then presented:

1. Search for new physics in beta-neutrino correlations using trapped ions and a retardation spectrometer (CERN-INTC-2005-014/P111 Add. 1), N. Severijns.
2. Studies of colossal magnetoresistive oxides with radioactive isotopes (CERN-INTC-2005-016/P132 Add.1), V. Amaral.
3. Measurement of gas and volatile elements production cross section in a molten lead-bismuth target (CERN-INTC-2005-017/P171 Add.1), L. Zanini.
4. Elastic scattering and fusion studies in the reactions $^{10,11}\text{Be}+^{64}\text{Zn}$ (CERN-INTC-2005-003/P192), A. Di Pietro.
5. Coulomb excitation of odd-mass and odd-odd Cu isotopes using REX-ISOLDE and Miniball (CERN-INTC-2005-004/P193), G. Georgiev.
6. A study of the r-process path nuclides, ^{137}Sb , ^{138}Sb , ^{139}Sb using the enhanced selectivity of resonance ionization laser ionization (CERN-INTC-2005-001/P191), W. Walters.
7. High accuracy mass measurement of the halo nuclides $^{12,14}\text{Be}$ (CERN-INTC-2005-009/P195), M. Sewtz.
8. Precision measurement of the half-life and the β -decay Q value of the super-allowed $0^+ \rightarrow 0^+$ β -decay of ^{38}Ca (CERN-INTC-2005-013/P196), D. Lunney.

CLOSED SESSION

Monday 21 and Tuesday 22 February 2004

Present: S. Åberg J. Äystö (Chairman), P. Butler, T. Butz, J. Engelen, L.M. Fraile (Secretary), M. Hauschild, D. Hilscher, M. Lewitowicz, M. Lindroos, G. Neyens, F. Priolo, D. Schinzel (replacing E. Radermacher), P. Woods.

Apologies: H. Doubre, M. Huyse, R. Krücken.

1. INTRODUCTORY REMARKS BY THE CHAIRMAN

The Chairman of the INTC, Juha Äystö, opened the session and welcomed the new members of the Committee. He reminded the Committee of the procedure for evaluation of the experiments proposals, which should include the judgement of the scientific merits, the viability, and the suitability of the requested number of shifts. The INTC is advisory to the Research Board (RB), thus it only makes recommendations to the RB for a final decision on the approval of the experiments.

2. MINUTES OF THE LAST MEETING

The minutes of the eighteenth INTC meeting from 15 and 16 November 2004 were approved without amendments.

3. STATUS OF ISOLDE

The Chairman of the Committee stressed the importance of this year for ISOLDE, with basically all the protons from the PSB delivered to the facility. He then remarked that the number of outstanding shifts from previous Committees at ISOLDE is approaching 600. Next he stated that the CERN management has requested that ISOLDE and nTOF organize a special scientific workshop to discuss present status and perspectives of the physics covered by the INTC, and to consider the possibilities and options for a future nuclear physics and astrophysics programme at CERN.

4. DISCUSSION ON THE OPEN SESSION

The Committee acknowledged the very good technical progress achieved at ISOLDE during the shutdown, and took note of the future completion of the radioactive class A laboratory and of the extension of the experimental hall. The news of the grant awarded to the ISOLDE RFQ project by the British funding agency were received with satisfaction. Many experiments will benefit from this development.

The Committee examined the conditions for the 2005 ISOLDE schedule, and stressed the importance of the beam development at REX-ISOLDE. The Committee stated that the proton intensity factor should be taken into account by the Scientific Coordinator when allocating shifts for the 2005 campaign. Experiments in the limit of feasibility and of high scientific impact should be scheduled with priority. The INTC encouraged the ISOLDE technical team to investigate the possibility of running experiments in parallel in the ISOLDE hall.

The proposals and addenda presented during the open session were then discussed.

P111 (CERN-INTC-2005-014/P111 Add. 1) *Search for new physics in beta-neutrino correlations using trapped ions and a retardation spectrometer*

This experiment aims at the determination of β - ν correlations in order to investigate the possible contribution of tensor and scalar components in the weak interaction with a precision of the order of 0.5%. After the installation of the WITCH setup and the preparation phase, the addendum presents a status report and the request to become a fully approved experiment. The scientific case was judged of the highest interest by the Committee and the installation period successful. The instrument still needs improvements and adjustments with stable beams, but a proper test of the recoiling ions into the spectrometer can only be achieved with radioactive species. A total of **18** radioactive beam **shifts** were **recommended** for approval by the Research Board for this purpose. The Committee urged the proponents to accomplish the necessary tests with stable beam and to install the large MCP detector at the end of the retardation spectrometer before the measurements.

P132 (CERN-INTC-2005-016/P132 Add. 1) *Studies of colossal magnetoresistive oxides with radioactive isotopes*

This addendum intends to continue the investigations of colossal magnetoresistive oxides employing radioactive probes from ISOLDE. The Committee judged the physics case of the highest quality, with special emphasis on the study of polaron dynamics and correlations, and on the investigation of the mechanisms associated with the isotopic effect of ^{18}O versus ^{16}O . The study of local distortions related to charge ordering, and the effect of order/disorder at A sites in perovskites were considered to be on a less well-established basis, but with enough interest to be pursued. The proposed tests of the local environment in “multiferroic” materials were seen to be in a very early stage but with certain interest. The proposed investigation of local defects in HfO_2 thin films using ^{181}Hf probe was considered highly attractive, but outside the scope of this addendum. The proponents are encouraged to come up with a separate proposal on this matter.

The collaboration was judged to be large enough to accomplish the proposed experiments satisfactorily and to achieve a very good characterization of the samples. The Committee encouraged the proponents to systematically use TEM to characterize all the samples before implantation. The Committee also noted that the outcome in terms of scientific publications is too poor, and expressed its strongest concern on this issue, urging the collaboration to revise their publication policy. The Committee **recommended** a total of **27** **shifts**, including 5 for tests, for approval by the Research Board.

P171 (CERN-INTC-2005-017/P171 Add. 1) *Measurement of gas and volatile elements production cross section in a molten lead-bismuth target*

This proposal intends the continuation of the measurements of the production of gas and volatile elements from a liquid PbBi target similar to that of the Megapie project at PSI, in order to understand the amount of radioactivity released. It is proposed to measure at a different energy than those stated in the original proposal, namely at 600 MeV, which is closer to the operation energy of 575 MeV of Megapie. Furthermore the proponents would like to measure the ion source efficiency in order to assess the main source of systematic

errors. The Committee supported the scientific case, and specially the measurement at low energy, but expressed its concern about the suitability of the measurements for the Megapie experiment at PSI, given the expected precision of the measurements to be not better than 30%. It also questioned the possibility of scaling from the ISOLDE target to the larger spallation target at PSI. The impact of the outcome of the experiment into the MEGAPIE project was also questioned due to the foreseen installation already in 2005. It was noted that the run is very difficult to schedule in conjunction with other runs and that the switchover to 600 MeV requires 2 days of setting up at the PSB and 1 extra day to return to the standard operation. Conditioned to the technical issues and the possibility of implementation of this scheme, the Committee decided to **recommend 8 shifts** for approval by the Research Board.

P191 (CERN-INTC-2005-001/P191) *A study of the r-process path nuclides, ^{137}Sb , ^{138}Sb , ^{139}Sb using the enhanced selectivity of resonance ionization laser ionization*

The proposal aims at the investigation of the decay properties of neutron-rich Sb isotopes relevant for the r-process. The understanding of the r-process is considered to be one of the most significant questions in nuclear astrophysics, and this experiment on Sb has only become possible recently due to the availability of a laser ionization scheme with the ISOLDE RILIS. The Committee considered the proposal of the highest interest and expected that the measurement, and in particular the P_n value, will help clarify the deviations between then observed abundances of isotopes around $A=138$ and the predictions of r-process calculations. Nevertheless it emphasized that a more efficient use of the beam time should be sought, both from the point of view of a possible combination of the experimental setups and by exploring the possibility of a fast flipping of the beam between two ISOLDE beamlines. The Committee **recommended** the **9 shifts** requested for 2005 for approval by the Research Board. A decision on the reminder of the requested shifts was delayed awaiting a report by the proponents to the Committee at the end of the year.

P192 (CERN-INTC-2005-003/P192) *Elastic scattering and fusion studies in the reactions $^{10,11}\text{Be}+^{64}\text{Zn}$*

The proposal focuses on the effects of the structure of halo nuclei in the mechanism of reactions below the Coulomb barrier, where an enhancement of the sub-barrier fusion may occur. The proposal aims at the measurement of the elastic scattering and the fusion excitation functions for the reactions $^{10}\text{Be}+^{64}\text{Zn}$ and $^{11}\text{Be}+^{64}\text{Zn}$. The physics case was judged as extremely compelling, especially the possibility of addressing this problem with a 2 body halo system, in comparison to previous studies with the 3-body halo nucleus ^6He . The experimental method was judged suitable, and the simultaneous measurement of the elastic channel very important for the calculations. Nevertheless, the Committee thought that the issue of the beam contamination should be studied prior to the experiment and stressed that the beam should be monitored online during the data taking. The Committee decided to support 6 shifts for evaluation of the beam components with ^{11}Be and ^{10}Be beams from REX-ISOLDE, to be computed under machine development time. While supporting the physics case, the decision on the recommendation of this proposal was **delayed** until a report on these tests is provided.

P193 (CERN-INTC-2005-004/P193) *Coulomb excitation of odd-mass and odd-odd Cu isotopes Using REX-ISOLDE and Miniball*

The proposal aims at the study of the properties of the odd-mass and the odd-odd neutron-rich Cu nuclei by means of the Coulomb excitation technique at REX-ISOLDE. It makes use of the selectivity of the RILIS ion source at ISOLDE to separate isomeric beams and eventually accelerate them. The scientific case was considered very compelling, with the possibility of investigating the interplay of single particle and collective effects and measuring effective proton and neutron charges in the vicinity of the N=40 gap. Especially the measurement of odd-odd Cu isotopes by using prepared states selected by RILIS was seen as highly attractive. As it was thought that the experiment could benefit from the increased proton intensity available in 2005 the Committee decided to **recommend** for approval by the Research Board a total of **29 shifts**, 20 for measurements and 9 for beam tuning and laser scans.

P195 (CERN-INTC-2005-009/P195) *High accuracy mass measurement of the halo nuclides $^{12,14}\text{Be}$*

The proposal intends the measurement of the masses of ^{12}Be and ^{14}Be with an accuracy of 10 keV, with the aim of improving the precision of the 2 neutron separation energy in order to achieve a better understanding of the ground state structure of the 2 neutron halo nucleus ^{14}Be . The proposal was thought to be well motivated and of scientific interest, with MISTRAL being at ISOLDE and it being the only setup capable of such a measurement of the mass of ^{14}Be with a half life of 4.5 ms. It was noted that the improved transmission by a factor 100 with the new beam cooler system is really required for a successful measurement. As no beamtime for online tests is requested, it was stressed that the offline tests should prove successful prior to the experiment. With this provision the Committee decided to **recommend 22 shifts** for approval by the Research Board.

P196 (CERN-INTC-2005-013/P196) *Precision measurement of the half-life and the β -decay Q value of the superallowed $0^+ \rightarrow 0^+$ β -decay of ^{38}Ca*

The proposal intends to contribute to the tests of the conserved vector current (CVC) hypothesis by determining the $\mathcal{F}t$ value of the superallowed $0^+ \rightarrow 0^+$ β -decay of ^{38}Ca . Accurate measurements of the half life, the $0^+ \rightarrow 0^+$ branching ratio and the Q value of the decay are required. The proponents intend to perform a high-precision study of the ^{38}Ca half life and a precise measurement of the Q_β value. The Committee judged the physics case of the highest importance and remarked the need of the measurement of the three required experimental quantities. It also expressed its concern about the difficulty of the measurement of the branching ratio. Furthermore, doubts were cast on the feasibility of a precise half life measurement in this case with the required precision of 0.1 %, given the similarity of the lifetimes of the mother and daughter activities (440 and 925 ms). Therefore the Committee decided to **recommend 5 shifts** for the determination of the Q_β value and requested the proponents to address the measurement of half life and the branching ratio in an addendum submitted to the Committee.

5. DISCUSSION ON ADDENDUM TO P156

P156 (CERN-INTC-2005-007/P156 Add. 2) *Coulomb excitation of neutron-rich A~140 nuclei*

The physics case for this experiment had already been positively evaluated by the Committee. The addendum comes in reply to the request of a preliminary analysis of the data on ^{122}Cd and ^{124}Cd and the examination of the data on isotope shifts in the region. This has been satisfactorily done, although difficulties to achieve the expected 10% precision on the B(E2) values cannot be excluded. The Committee decided to **recommend** approval of **15 shifts** to perform the measurements on the $^{138,140,142,144}\text{Xe}$ and account for the all the preparations and the involved beam changes at REX-ISOLDE. The Committee also encouraged the development of the Ba beams subject to the availability of beam development time at ISOLDE.

6. LETTERS OF INTENT

Letter of Intent: Decay study of neutron-rich At isotopes with a chemically selective negative ion source (CERN-INTC-2005-002/I055)

Letter of Intent (CERN-INTC-2005-012/I059): *Precision measurement of the half-life, of non-analogue branches and of the β -decay Q value of the superallowed $0^+ \rightarrow 0^+$ β -decay of ^{70}Br*

Both letters of intent request the development of a negative ion source. While the physics case for the letter I59 was considered convincing and on the same footing as the proposal P196 discussed above, the physical basis for the letter of intent I55 was questioned, as the octupole vibrational character of the even Rn isotopes neighbouring the proposed odd isotopes has already been determined. Therefore the Committee showed its support for the letter of intent I59 and but not for I55. The Committee considered that the development of a negative ion source will open up new possibilities for the science at ISOLDE and strongly encouraged its development in the benefit of the physics programme.

Letter of intent (CERN-INTC-2005-008/I057): *In-source laser spectroscopy of Po*

This letter of intent asks for the development and test of RILIS ionisation schemes for Po, as a first step for future measurements of the isotope shifts and magnetic moments of n-deficient Po isotopes. Since there are no stable Po isotopes, it is requested to do the tests online with short-lived isotopes and the RILIS, and to check the production of exotic Po. The Committee supported the development conditioned to the availability of resources and the feasibility to schedule those tests.

Letter of intent (CERN-INTC-2005-010/I058): *Low-energy Coulomb excitation of ^{78,80,82}Ge with REX-ISOLDE and Miniball*

This letter of intent requests the development of pure Ge beams by using GeS molecular sidebands in order to perform Coulomb excitation studies of neutron rich Ge isotopes at REX-ISOLDE. The Committee judged the physics case of the greatest importance, took note of the letter of intent and encouraged the proponents to make a full proposal. The tests should be part of the beam development time and should be subject to the availability of resources and the target development priorities.

7. A.O.B.

The next INTC meeting will take place on **Monday 23 and Tuesday 24 May 2005**. The deadline for submission of proposals is **Friday 22 April 2005**.

The remaining INTC meeting in 2005 will take place in 31 October and 1 November 2005.

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