

ISOLDE AND NEUTRON TIME OF FLIGHT  
EXPERIMENTS COMMITTEE

Minutes of the twenty first Meeting of the INTC  
Held on Monday 15 and Tuesday 16 November 2004

**OPEN SESSION**

Monday 15 November at 13:30 h, Council Chamber

The Chairman of the INTC, Juha Äystö, opened the meeting and announced the agenda.

The ISOLDE Technical Coordinator, Mats Lindroos, reported on the ISOLDE 2004 campaign. Since July the GPS operation has been limited to 30 kV, possibly due to a problem with the insulator. Moreover, the GPS has been running with a single vacuum pump. In addition, a vacuum pump of the HRS had to be replaced in October after both had stopped functioning throughout the year. It has been found that the HRS resolution is limited due to a design fault. A decision on the future of HRS is to be taken at the standing group for the upgrade of ISOLDE. The front-end #6 has been assembled, and is awaiting a ceramic insulator. It will be tested in building 275 before installation in March 2005.

The REX-ISOLDE operation was then discussed. The agreed five posts have been filled but nevertheless the staff situation is critical during the running period, and the technical support for the low energy stage is still insufficient. An operation team will be formed for on-call support and setting-up. It was pointed out that there is a need for scheduled development time for new beams. Some technical developments achieved during the year were also discussed, namely the new accelerating scheme to 3.0 MeV/u, newly accelerated isotopes, improvements in the charge breeding efficiency and the development of molecular beams.

Afterwards, the ISOLDE organization was reviewed in terms of the CERN general structure and the different responsibilities, with the forecast of the EURISOL and EURONS positions to be filled in 2005. The ISOLDE operations piquet will be composed of 5 people, assuring that a technician is available in the ISOLDE control room for 4 hours each working day.

Finally, the shutdown planning was discussed. There will be no cooling water available and possible power cuts in the period 10 December 2004 to 18 January 2005. The start of off-line running is planned for 21 March 2005 and the start-up of the Physics programme on 25 April, pending the approval of the accelerator schedule by the Research Board. During the shutdown, the new front-end will be installed, the REX EBIS magnet will be repaired and the extension of the hall will proceed with the removal of the partition wall.

The ISOLDE Scientific Coordinator, Luis M. Fraile, summarized the ISOLDE 2004 operational period and presented the running statistics. A total of 320 shifts of radioactive beam have been delivered to approved experiments, target tests and beam developments during the online period. The breakdown of the beam time in the different subfields was shown, with 235 shifts provided to experiments in the fields of Nuclear Physics, Atomic Physics, Astrophysics, Solid State Physics and Life Sciences. About one third of these were delivered to experiments at the REX-ISOLDE facility. It was noticed that the allocation to Solid State Physics had noticeably decreased.

He then stressed the increasing number of shifts for REX-ISOLDE and the rich Physics output in 2004, with the upgraded energy to 3.0 MeV/u. Afterwards he presented a few highlights from the scientific programme and discussed the proposed accelerator schedule for 2005 together with practical issues for the winter shutdown, including the extension of the ISOLDE hall.

The nTOF-ND-ADS Project Coordinator, Alberto Mengoni, reported on the 2004 run for the nTOF facility. After the successful installation and commissioning of the total absorption calorimeter in the experimental area, the first measurement with a radioactive sample took place in August 2004. The TOF for the BaF<sub>2</sub> signals is determined by means of a simulated constant fraction discriminator allowing for the distinction of  $\alpha$  and  $\gamma$ , and for pileup analysis. Next, he described the performance of the neutron absorber and reviewed the capture measurements completed during 2004 by using the <sup>233</sup>U, <sup>234</sup>U, <sup>237</sup>Np, <sup>240</sup>Pu and <sup>243</sup>Am radioactive targets. The <sup>241</sup>Am could not be used due to the CERN safety regulations. He then briefly discussed the ongoing fission measurements.

The total number of protons received by the facility is slightly below the expected number; in week 45 it amounts to  $1.25 \times 10^{19}$ . As the contract with the EU within the FP5 ends in December 2004, he summarized the main objectives of the project, namely the measurement of neutron cross sections relevant for nuclear waste transmutation, and those relevant for Nuclear Astrophysics, and the use of neutrons as probes for fundamental Nuclear Physics. The perspectives for the facility include the improvement of safety requirements in the target area, the use of D<sub>2</sub>O or H<sub>2</sub>O with <sup>10</sup>B admixture as target coolant and the construction of a second neutron beam-line at around 20 m from the spallation module and at 90° from the proton beam line. A rich experimental programme is envisaged for the continuation of the nTOF facility.

The following proposals and status reports were then presented:

1. Coulomb excitation of neutron-rich A~140 nuclei (INTC 2004-026/P156 Add.1), Thorsten Kröll.
2. Study of neutron-rich Be isotopes with REX-ISOLDE (INTC-2004-023/P187), Karsten Riisager.
3. Beta-asymmetry measurements in nuclear  $\beta$ -decay as a probe for non-Standard Model physics (INTC-2004-027/P189), Nathal Severijns.
4. Diffusion of Mn-52 in GaAs (INTC-2004-028/P190), Jyrki Raisanen.
5. REX-ISOLDE Status Report (INTC-2004-030/SR-003), Heiko Scheit.
6. Status Report on High precision mass measurements of exotic nuclei with the triple-trap mass spectrometer ISOLTRAP (INTC-2004-020/SR-002), Alexander Herlert.

## **CLOSED SESSION**

Monday 15 and Tuesday 16 November 2004

**Present:** J. Äystö (Chairman), P. Butler, T. Butz, P. Cennini, L.M. Fraile (Secretary), M. Hauschild, D. Hilscher, M. Huyse, J. Kluge, M. Lewitowicz, M. Lindroos, E. Radermacher, J. Suhonen and D. Warner.

**Apologies:** H. Doubre, F. Priolo, P. Woods.

### **1. INTRODUCTORY REMARKS BY THE CHAIRMAN**

J. Äystö opened the session and explained that he will present the outcome of the INTC meeting to the Research Board on 2<sup>nd</sup> December 2004. He encouraged the participation of the ISOLDE Workshop, to be held at CERN from 13<sup>th</sup> to 15<sup>th</sup> December 2004.

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

The minutes of the eighteenth INTC meeting from 25<sup>th</sup> May 2004 were approved without amendments.

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

The 2004 campaign was judged very fruitful for ISOLDE and without major difficulties. The transition for REX-ISOLDE to become a CERN operated facility is gradually improving and the discussion of support for the ISOLDE experimental areas is in progress. Some developments are taking place including the successful test of the ECR, which nonetheless suffers from a high level of contaminants. An experiment addendum will be submitted shortly to the Committee, and the problem will be addressed within the EURONS project beginning in 2005. A comparison between ECR and EBIS should then be undertaken.

The issue of isobaric contaminations in the ISOLDE beam was brought forward. In this context a new design for the suppression of surface ionized species in the RILIS is underway, and the project for a RFQ at ISOLDE is pending while a decision on funding is taken. The need for a high resolution separator was also addressed; a decision has to be taken by the ISOLDE Upgrade group with the input of the Physics community.

The extension of the ISOLDE experimental hall is in progress; it should be ready by 15 March 2005. An additional 200 kCHF has been granted by the DG reserve to partially compensate for the cost overrun of this project.

The Committee took note of the delivered scientific report and operational statistics. It was requested that the Physics Coordinator report on the ratio of scheduled shifts compared to delivered shifts and on the number of shifts normalized to time, in order to evaluate the impact of eventual target breakdowns. The Committee congratulated the ISOLDE team for another successful year of operation and for an outstanding Physics output.

#### 4. STATUS OF nTOF

The Committee took note of the very active 2004 campaign for nTOF, with an integrated number of protons close to the expected value and a wealthy Physics programme, and congratulated the nTOF team for another successful year of operation. The replacement of the target coolant by heavy water was eventually not done. Almost all of the planned measurements have been accomplished, and the final report for the European FP5 project is due at the end of February 2005. There is much interest in a potential nTOF campaign after 2005 so, with the input of the Physics community, the Physics case will be compiled for the continuation of the nTOF activities at CERN after the upgrade of the present infrastructure. The Committee underlined that new proposals from the nTOF community are welcomed for 2006.

#### 5. DISCUSSION ON THE OPEN SESSION

The presentations of the proposals, addenda and status reports made during the open session were then discussed.

##### **P156 (INTC-2004-026/P156 Add.1)** *Coulomb excitation of neutron-rich A~140 nuclei*

The Physics case had already been positively evaluated and was still considered of the highest interest. The extension of the measurements to the Te isotopes will add significance to the proposal, given the recent counterintuitive results from other facilities on the B(E2) behaviour in Te isotopes. Nevertheless, the addendum was judged premature given the lack of final results from the recent REX-ISOLDE experiment on the Cd isotopes. The Committee decided to **recommend** approval of **6 shifts** to, together with the remaining shifts, complete the measurement on  $^{126}\text{Cd}$ . The decision on the rest of the proposed beam time was delayed until results are provided. The Committee stressed that the proponents should take into account the existing high-quality data on isotope shifts, to be compared with the measured B(E2) values.

##### **P187 (INTC-2004-023/P187)** *Study of neutron-rich Be isotopes with REX-ISOLDE*

The proposal aims at the measurement of reactions with a  $^{11}\text{Be}$  beam on a deuterium target in order to extract information on the structure of the  $^{10,11,12}\text{Be}$  isotopes. The proponents have gained experience on particle setups at REX for low energy transfer reactions with a  $^9\text{Li}$  beam, and they plan now to investigate reactions with  $^{11}\text{Be}$  and possibly  $^{12}\text{Be}$  using the same method. It is expected that the problems with A/Q contamination can be eluded by using stripping foils and changing of the buffer gas. The Committee **recommended 29 shifts** for approval by the Research Board and encouraged the proponents to pursue the final goal of measurements with a  $^{12}\text{Be}$  beam.

##### **P189 (INTC-2004-027/P-189)** *Beta-asymmetry measurements in nuclear $\beta$ -decay as a probe for non-Standard Model physics*

The proposal aims at the measurement of the beta asymmetry parameter in several beta-decays for the investigation of possible tensor contributions to the weak interaction. The Committee judged the proposal as well-founded and highly attractive, especially the relative measurement for  $^{79}\text{Kr}$  and  $^{85\text{m}}\text{Kr}$ . The achievement of a precision of 1% or better

in the beta asymmetry parameter was regarded as a substantial improvement to present measurements. For the experiment with Br isotopes a negative voltage supply is required to work with the ISOLDE negative ion sources. The Committee encouraged this development and **recommended** to the Research Board an allocation of **17 shifts**: 10 shifts for the measurement of the  $\beta$ -asymmetry parameter of  $^{79}\text{Kr}$  and  $^{85\text{m}}\text{Kr}$ , 5 shifts for the  $^{67}\text{Cu}$  and  $^{68}\text{Cu}$  and 2 more shifts for the calibration with  $^{82}\text{Rb}$  and  $^{118}\text{Sb}$  of the Geant calculations of the  $Q^0$  factor.

**P190 (INTC-2004-028/P-190)** *Diffusion of  $^{52}\text{Mn}$  in GaAs*

The proposed experiment intends to study the diffusion mechanism of Mn in GaAs and to assess the role of the Ga vacancies in the Mn diffusion process. The Committee reacted very positively to this investigation with state-of-the-art techniques including ion implantation, diffusion annealing and study of the diffusion profile. The uniqueness of the ISOLDE facility for this type of research was also noted. An allocation of **6 shifts** was **recommended** to the Research Board.

**Status report (INTC-2004-030/SR-003)** *REX-ISOLDE*

The Committee took note of the excellent developments and Physics output of the 2004 campaign. The ISOLDE and REX-ISOLDE teams were congratulated for the successful series of experiments.

**Status report (INTC-2004-020/SR-002)** *High precision mass measurements of exotic nuclei with the triple-trap mass spectrometer ISOLTRAP*

The 2004 campaign was judged very fruitful by the Committee, with a remarkable scientific output. The 25 radioactive shifts requested for 2005 concern isotopes already included in the initial proposal and well justified, so the Committee decided to **recommend 25 shifts** for allocation by the Research Board.

## **6. DISCUSSION ON ADDENDA TO P158 AND P162**

**P158 (INTC-2004-025/P-158-Add.2); IS412** *Coulomb excitation of neutron-rich nuclei between the  $N=40$  and  $N=50$  shell gaps using REX-ISOLDE and the Ge MINIBALL array*

This addendum intends the continuation of the investigation of Coulomb excitations for  $^{74-80}\text{Zn}$  and  $^{68-70}\text{Ni}$ . The Physics case had already been positively evaluated and was still considered very convincing. The reallocation of the remaining shifts for the measurement of  $^{78}\text{Zn}$  and the determination of the first excited  $2+$  state in  $^{80}\text{Zn}$  was agreed. In spite of the higher expected counting rates at 3.0 MeV/u, the extraction of the  $B(E2)$  values from the Coulomb excitation of the Ni isotopes was seen as very demanding. The Committee encouraged the initiation of the Ni program with emphasis on  $^{70}\text{Ni}$ . With this aim it **recommended 9 shifts** to the Research Board. The decision on the remainder of the proposed beam time was delayed until results on the analysis of the Zn isotopes are provided.

**P162 (INTC-2004-029/P-162-Add1); IS414** *Advanced Time-Delayed coincidence studies of  $^{31,32}\text{Mg}$  from the beta-decays of  $^{31,32}\text{Na}$*

The Physics case had already been presented and was still considered of the highest importance by the Committee. The improvement of precision on the 885 keV level life time in  $^{32}\text{Mg}$  to the level of 10% was regarded as challenging and it was pointed out that the enhancement on the efficiency of the experimental setup was not explicit in the addendum. The extension of the program towards  $^{33}\text{Mg}$  was judged very significant in the framework of fast timing measurements on the island of inversion. In contrast, the determination of the E0 transition rates was considered difficult to judge at the present stage, until evidence for the existence of E0 transitions exists. Therefore, the Committee **recommended** to the Research Board the approval of a total of **22 shifts**: 11 for the precision measurement of  $^{32}\text{Mg}$ , 9 for a fast timing experiment on  $^{33}\text{Mg}$  and 2 for tests on E0 measurements on  $^{30}\text{Mg}$ .

**7. DISCUSSION ON PROPOSAL P173 AND ADDENDUM TO PROPOSAL P135**

**P173 (INTC-2003-016/P-173)** *Parity non-conservation in nuclei: the case of  $^{180m}\text{Hf}$  revisited*

The P173 experiment investigates the existence of parity non conservation effects in the nuclear gamma-decay of  $^{180m}\text{Hf}$ . The decision on this proposal had been postponed pending a test of the lifetime and performance of the target-ion source combination. This test has now been carried out with successful results reported by the proponents. In the light of the feasibility of the experiment and the reported beam intensities the Committee decided to **recommend 7 shifts** for approval by the Research Board.

**P135 (INTC-2004-014/P-135 Add.1)** *Beta-decay study of very neutron-rich Cd isotopes with a chemically selective laser ion source*

The decision on this addendum dealing with the investigation of  $^{131}\text{Cd}$  and  $^{132}\text{Cd}$   $\beta$ -decays was postponed on the twentieth Meeting of the INTC. The questions posed then by the Committee have been now addressed by the proponents. Although not given quantitatively, the theoretical calculations minimize the role of the  $2^-$  states in the decay pattern. In spite of not being very convincing, the arguments for the identification of the spin-parity of the levels based on the  $\beta$  and  $\beta$ -n decays and the shell structure were judged sufficient for the identification of the low-lying  $f_{5/2}$ ,  $p_{3/2}$  and  $p_{1/2}$  states.

In view of the technical challenges to accomplish this experiment, the request for 50 shifts was not seen as feasible in the present ISOLDE context. Nevertheless a reduced beam time with certain restrictions could be allocated. Firstly, the run should preferably be scheduled during 2005 for an efficient use of the increased proton beam intensity. Secondly, the performance of the target should be assessed in the beginning of the run in order to judge whether the experiment is feasible. If this is not the case, the beam should be diverted to other users to avoid any loss of beam time. The proponents should then seek improvements of the experiment and report them to the Committee before a further request for beam time allocation. Furthermore, the implementation of the quartz transfer line in the target should be carried out prior to the experiment in coordination with the ATB IF group. With these provisions the Committee decided to **recommend 21 shifts** in

order to finish the measuring program on Cd isotopes, with particular weight on the  $^{132}\text{Cd}$  decay.

## 8. LETTERS OF INTENT

### **Letter of Intent: Production of generator source of alpha-emitters for radiotherapy (INTC-2004-012-I-052)**

The discussion of this letter of intent was postponed at the twentieth meeting pending answers to questions put forward by the Committee. New information has now been received from the spokesperson, clarifying most of the points. However the expected clinical advantages of the new decay alpha chain are still not patent to the Committee. The latter point should be addressed if a proposal on this subject is submitted, together with the description of the experimental group involved in eventual experiments at ISOLDE and the precision of whether the generator source has to be shipped to other laboratories. With these remarks, the Committee **took note** of the Letter of Intent.

### **Letter of Intent: Preparation & implantation of carrier-free $^{115\text{m}}\text{Cd}$ in calcium nitrate salt (INTC-2004-022/I-054)**

This letter of intent addresses the problem of the effect of submicron colloidal particles in the determination of metal lability and fixation processes in soils when isotopic dilution techniques are used. In particular, due to its toxicity, the bioavailability of Cd has an important role in environmental research. The proposed technique is a double labelling combining  $^{109}\text{Cd}$  and  $^{115\text{m}}\text{Cd}$ . The Committee **considered** the Letter of Intent with interest, but pointed out potential problems. In particular, the benefit of using the combination of  $^{115\text{m}}\text{Cd}$  and  $^{109}\text{Cd}$  compared to  $^{109}\text{Cd}$  is not satisfactorily explained. Furthermore, the possibility of the exchange of the  $^{109}\text{Cd}$  and  $^{115\text{m}}\text{Cd}$  species, which, if it occurs, would spoil the measurement, should be investigated in order to show that the Cd complexes are stable. An eventual proposal by this collaboration should address these concerns and explore other possibilities of studying the Cd mobility with for instance NMR with stable  $^{113}\text{Cd}$  or  $^{109}\text{Cd}$  electrophoresis. The fraction of the beam used in parasitic mode and the local contacts at ISOLDE should be also specified.

## 9. A.O.B.

The Chairman thanked the outgoing members, J. Kluge, J. Suhonen and D. Warner, expressing his gratitude to their contributions to the Committee.

The next INTC meeting will take place on **Monday 21 and Tuesday 22 February 2005**. The deadline for submission of proposals is **Friday 21 January 2005**.

The dates of the other two INTC meetings in 2005 are fixed at 23 and 24 May 2004, and 31 October and 1 November 2005.

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