

ISOLDE AND NEUTRON TIME OF FLIGHT
EXPERIMENTS COMMITTEE

Minutes of the twenty third Meeting of the INTC
Held on Monday 23 May 2005

OPEN SESSION

Monday 23 May 2005 at 13:30 h, Council Chamber

The Chairman of the INTC, Juha Äystö, opened the Meeting and announced the agenda. He then introduced the Nuclear Physics and Astrophysics at CERN (NuPAC) Meeting, to be held at CERN from 10 to 12 October 2005. The Meeting is a response to the request by CERN for a revision of the scientific case for Nuclear Physics and Astrophysics at the ISOLDE and nTOF facilities.

The ISOLDE Technical Coordinator, Mats Lindroos, reported on the technical activities at the facility. He briefly reviewed the progress of the technical work during the shutdown period and highlighted the completion of the laboratory for target manipulation, the alignment of scanners and Faraday cups and the completion of the new ISOLDE front-end. Other developments were underlined, for example the new ionization scheme for Hg beams with the RILIS and the progress on the ISOLDE RFQ cooler. He also informed the Committee of the completion of the ISOLDE hall extension and of the upcoming installation of cooling water, electrical supplies and the ventilation system. Although the startup of the facility was successful, he reported the breakdown of two targets in close succession, and he stressed the poor performance of the ISOLDE controls, with response times larger than 10 seconds.

Concerning REX-ISOLDE he summarized the accomplished maintenance work, with emphasis on the intervention on the superconducting coil of the REX-EBIS in order to reduce the boil-off rate, the implementation of a new control system for REX-TRAP and the repair of the 202 MHz REX-LINAC cavity. It was stressed that the present gas recovery system at ISOLDE will need to be modified to collect the exhaust gases coming from REX-TRAP and from the RFQ cooler when it eventually comes into operation.

The new members of the ISOLDE technical staff were introduced and the reorganization of the technical support for ISOLDE experimental areas, now under responsibility of the ATB-IF section, discussed.

He then briefly outlined the HIE-ISOLDE project, a major undertaking for the upgrade of ISOLDE. It aims at boosting the energy and intensity of the radioactive beams available at the facility, and will benefit a wide spectrum of research fields. The project will take advantage of injector upgrades at CERN, and foresees a staged approach to increasing the

energy at REX-ISOLDE, first to 5.5 MeV/u and then 10 MeV/u. A memorandum describing the project and discussing the case for high intensity and energy radioactive ion beams has recently been submitted by P. Butler and M. Lindroos to the PH and AB department leaders. The project will be examined in detail at the NuPAC Meeting in October 2005.

The ISOLDE Scientific Coordinator, Luis M. Fraile, presented the schedule for the 2005 campaign. The tests for the reduction of the basic cycling period to 900 ms at the LINAC2 and PSB have now been fixed for weeks 21 to 24. This leaves 25 weeks for physics at ISOLDE within the period 25 April to 31 October. The main constraints are the limit of 150 physics shifts per year that can be delivered by the RILIS, the restricted number of uranium carbide targets that can be produced by the AB/ATB/IF section and the operation of REX-ISOLDE. The latter was ready for the first scheduled experiment in May 2005; it will not be available for experiments during weeks 25 and 26 due to changes in the power supply controls. The MINIBALL Ge detector array was operational at CERN on 20 May, and it will be present at ISOLDE until the end of the running period.

He then informed the committee that there are 579 outstanding 8-hour shifts from 2004. Together with the shifts approved in the first INTC Meeting of 2005 the total amount exceeds 700 shifts, without including target and ion source development nor time allocated to REX machine development. Out of the 700 remaining shifts, 225 correspond to REX-ISOLDE physics, 150 of them with the MINIBALL array. The beam requests by the ISOLDE users for 2005 amount to 500 shifts, 170 of them for REX-ISOLDE. This number includes specific target and ion source developments. Out of the 500 shifts, 300 require UC_x targets. Furthermore, the RILIS is needed for 200 shifts. Considering the above data and limitations the ISOLDE schedule has been composed. It can be found at <http://www.cern.ch/isolde/> under the epigraph 'Schedule'. Among other useful information, the page includes links to documents with the physics requirements for each of the ISOLDE targets, and to detailed weekly schedules for every week of operation.

The first weeks of operation and the upgrades of experimental equipment at the ISOLDE facility were then briefly summarized. Afterwards, the new procedures to access CASTOR data from external sites in compliance with the new CERN procedures were discussed. A protocol proposed for data transfers in GRID environments, GridFTP, should now be used for transfers from CERN to an external location and vice versa. This requires a proper registration of ISOLDE and of each individual user within the GRID system.

The following proposals were then presented:

1. Charge Breeding of Radioactive Ions in an Electron Cyclotron Resonance Ion Source (ECRIS) at ISOLDE (CERN-INTC-2001-023/P143 Add. 1), C Barton.
2. nTOF-Ph2: The physics case and related proposal for measurements at the CERN Neutron Time-of-Flight facility nTOF in the period 2006-2010 (The nTOF-Ph2 initiative) (CERN-INTC-2005-021/P197), A Mengoni.

CLOSED SESSION

Monday 23 May 2005

Present: S. Åberg, J. Äystö (Chairman), P. Butler, T. Butz, P. Cennini, H. Doubre, L.M. Fraile (Secretary), M. Hauschild, D. Hilscher, R. Krücken, M. Lindroos, G. Neyens, E. Radermacher, M. Streit-Bianchi and P. Woods.

Apologies: J. Engelen, M. Huyse, M. Lewitowicz, F. Priolo.

1. INTRODUCTORY REMARKS BY THE CHAIRMAN

The Chairman opened the session and welcomed R Krücken, who attended this meeting for the first time. He then stressed the importance of the NuPAC Meeting, to be held in October 2005, for the Physics programmes of ISOLDE and nTOF (see Section 5).

2. MINUTES OF THE LAST MEETING

The minutes of the twenty second INTC Meeting from 22 February 2005 were approved.

3. DISCUSSION ON THE OPEN SESSION

The Committee acknowledged the technical progress achieved at ISOLDE during the shutdown and underlined the fact that ISOLDE is the only accelerator-based facility at CERN acquiring data. The facility was ready for the start up as scheduled, but unfortunately two targets failed simultaneously one on each separator. One of them was a UC_x target which had been heated for long time in order to remove La contamination. The second one was a SiC prototype with a graphite insert in the ionizer. The diffusion of C into the Ta grain boundaries weakened the Ta container, which eventually broke. The start-up of REX-ISOLDE was hampered by the simultaneous failure of two transformers, but the REX team managed to recover for the start of experiments. The slow extraction from the REX-EBIS has not yet been implemented, but it is planned for the next shutdown.

4. DISCUSSION ON PROPOSALS AND LETTERS OF INTENT

P143 (CERN-INTC-2001-023/P143 Add. 1) *Charge Breeding of Radioactive Ions in an Electron Cyclotron Resonance Ion Source (ECRIS) at ISOLDE*

This addendum intends to continue the experiment IS397, which investigates the charge breeding of radioactive isotopes from ISOLDE by a PHOENIX Electron Cyclotron Resonance Ion Source (ECRIS). The main goals of the addendum are the test of the so-called afterglow method with stable and radioactive isotopes, the optimization of the injection methods, the study of the loss mechanisms and the continuation of the measurements of charge breeding efficiency, including a systematic comparison with the REX Electron Beam Ion Source (EBIS).

The continuation of this technical development was judged by the Committee to be of the highest interest for ISOLDE. A test with radioactive beams under real conditions is highly desirable, and in particular the beam purification should be addressed. The feasibility of a direct comparison of breeding methods between EBIS and ECRIS for ion sources, otherwise quoted as complementary, was taken with certain reservations. Nevertheless, the investigation of light ions and higher intensities was judged to have the greatest relevance. The Committee decided to **recommend 20 shifts** for approval by the Research Board. As all the shifts cannot possibly be allocated in 2005 the proponents should be prepared for an extension of the programme to the 2006 campaign.

P196 (CERN-INTC-2005-013/P196 Add. 1) *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 aims at the determination of the $\mathcal{F}t$ value of the superallowed $0^+ \rightarrow 0^+$ β -decay of ^{38}Ca as a contribution to the test of the conserved vector current (CVC) hypothesis. Three main experimental quantities are needed for such a test, namely the half life, the $0^+ \rightarrow 0^+$ branching ratio and the Q value of the decay. The measurement of the Q_β value was already recommended by the INTC in an earlier Meeting, but the proponents were requested to revise their proposal for the measurement of the ^{38}Ca half life. The present addendum comes as a response to this request.

The method originally proposed to determine the half life is unable to yield the required precision due to the fact that the daughter half life is only a factor of two longer than the parent one. For this reason the proponents intend an alternative method by using β - γ coincidences with the 1.57 MeV γ -ray with a 20% branching ratio. In spite of the new method, doubts were cast on the actual efficiency of the NaI detector, the effects of summing with 511 keV γ -rays and the rate of background β - γ coincidences. Moreover, despite the total efficiency of 10%, the amount of requested beam time is only a factor 2 higher than the original proposal. Therefore the Committee decided to **recommend 7 shifts** for a feasibility test of the half life measurement.

I60 (CERN-INTC-2005-020/I60) *Study of the $\pi h^{-1}_{11/2}$ isomeric states in $^{201,203,205}\text{Au}$*

This letter of intent requests the development of gold beams at ISOLDE with the purpose of investigating the N=126 closed shell ^{205}Au nucleus by studying the decay of the isomeric $\pi h^{-1}_{11/2}$ state. The investigation of the decay of the analogous states in ^{201}Au and ^{203}Au is also intended. The Committee acknowledged the need of experimental data in this region, and judged the case very important and complementary to the study of μs isomers in other facilities. The Committee encouraged the development of gold beams at ISOLDE and **endorsed the letter of intent**.

P197 (CERN-INTC-2005-021/P197) *nTOF-Ph2: The physics case and related proposal for measurements at the CERN Neutron Time-of-Flight facility nTOF in the period 2006-2010 (The nTOF-Ph2 initiative)*

This proposal has been submitted to the INTC to initiate the discussions on a new research phase at the nTOF facility at CERN. The document has been compiled by three scientists on behalf of a new team, which lays its foundations on the former nTOF Collaboration. The proposal drafts the physics research to be carried out during the next 5 years, and describes the basic technical developments needed for a substantial increase of the sensitivity. Particular emphasis is given to an additional beam line with flight path of the order of 20 m that will allow an increase of the neutron flux by two orders of magnitude.

The Committee judged the astrophysics case extremely compelling and well established, making nTOF a potentially unique facility for studies of this kind. The use of radioactive targets from ISOLDE should be investigated in detail. With regard to the nuclear structure programme, the Committee encouraged the Collaboration to develop the ideas outlined in the proposal, and recommended the inclusion of more scientists working in this field. Concerning nuclear data for accelerator-driven systems, the particular isotopes need to be discussed in depth in specific proposals. Although most of the measurements for minor actinides have been performed, the capture measurements are still to be completed and crucial cases can be addressed with small samples in the proposed short flight path station. The Committee felt that the possibility of measuring beta-delayed neutrons should also be explored.

Concerning the facility itself the Committee encouraged the nTOF Collaboration to take all necessary steps to create a world leading facility. This should include the replacement of H₂O by D₂O as a target coolant, the construction of an additional short flight path tunnel, and the exploration of the synergies with ISOLDE. All the safety issues should be clarified prior to the upgrade of the present facility. Dieter Hilscher suggested the possibility of having several measurement stations with 20 m flight path integrated in a single experimental area for an increased efficiency. The Committee urged the Collaboration to further explore this idea.

In summary, the Committee underlined the uniqueness of both the presented physics case and the new facility. The scientific programme was seen as highly compelling, and in particular the astrophysics studies. The proponents are encouraged to develop complete proposals tackling specific scientific topics and present them to the INTC. The Committee took note of insufficient number of publications from the previous nTOF research programme, which may undermine the present proposal. The physics case will be addressed in detail in the INTC NuPAC Meeting in October 2005.

5. INTC Meeting on Nuclear Physics and Astrophysics at CERN (NuPAC)

The CERN Directorate and the CERN Research Board has asked the INTC to review the scientific case for the Nuclear Physics and Astrophysics programme carried out at the ISOLDE and nTOF facilities. For this reason, the Nuclear Physics and Astrophysics at CERN (NuPAC) Meeting will be organized from 10 to 12 October 2005. Invited scientists will present their research activities and discuss plans for future initiatives.

The NuPAC local organizing Committee proposed the general scheme of the Meeting. It will be divided in specific sessions, each of them having several conveners responsible

for the proposals for participants and for the actual organization of the presentations at the Meeting. The members of the INTC will serve as International Advisory Committee.

The aim is to deliver a scientific report on the outcome of NuPAC at the INTC Meeting scheduled for 31 October and 1 November 2005. The Committee agreed to the general structure of the Meeting and discussed the contents of the session and the proposals for conveners.

6. A.O.B.

The Chairman thanked the outgoing members, P. Butler, M. Hauschild and D. Hilscher, expressing his profound gratitude for their contributions to the Committee.

The next INTC Meeting will take place on **31 October and 1 November 2005**. The deadline for submission of proposals is **Friday 30 September 2005**.

The **NuPAC Meeting** will take place on **10–12 October 2005**.

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