

ISOLDE AND NEUTRON TIME-OF-FLIGHT
EXPERIMENTS COMMITTEE

Minutes of the 37th meeting of the INTC
Held on Wednesday 23 and Thursday 24 June 2010

OPEN SESSION (part 1)

Wednesday 23 June 2010 at 10:00-12:10 h, Anderson room (40-S2-A01)

The Chairman of the INTC, Peter Butler, opened the first part of the open session and announced the agenda.

ISOLDE Technical Report

A summary of the front-end exchange was given by Alexander Herlert, who replaced Richard Catherall as representative from the ISOLDE technical group at this meeting. Part of the work covered the installation of the new Boris tube which should allow the experiments to receive 60 keV beam from the HRS. Furthermore, the new vacuum system was introduced which was a major upgrade including new vacuum and controls equipment for the experimental beam lines and the front-end as well as the separator areas. The main shutdown work included the maintenance of the target area with a revision of the robots, new cameras, and new controls for the target coupling. In addition, many tasks were performed to improve the operation in the experimental hall: The RFQ controls have been migrated, the leaking air conditioning was repaired, an overhaul of scanners and Faraday cups was done, and a repair of the main high-tension power supplies and the exchange of laser windows was performed.

For REX-ISOLDE further progress of the REXTRAP control system upgrade was reported. Likewise, the controls of the REX-ISOLDE beam instrumentation were replaced with CERN standard systems. In addition, an extension of the shielding of the WITCH magnetic stray field was discussed as it still hampers the REX-ISOLDE operation. While during the start-up of the REX-EBIS a problem with the boil-off rate of the liquid helium was observed - without a trace of vacuum leaks. The EBIS cathode poisoning is not solved, even after very thorough testing. The technical group is looking for new manufacturers and possible test-bench systems for a further detailed investigation the problem. The LINAC shielding has been completed and the RF cooling and ventilation has been improved with better temperature stability and longer RF tube lifetime. Furthermore, the new tuner mechanics for the 7-gap resonators was installed and showed improved reliability and stability. Two more units will be installed soon.

The new RILIS pump lasers were modified in the shutdown to improve the optics and to have more power on the 532nm beam due to an adjustable power distribution. The old copper vapour lasers were finally removed and replaced with new dye lasers from Syrah.



The report was concluded with a remark on the target and ion-source development. The recently applied nano-structured material Y_2O_3 coupled to a VADIS ion source showed promising results for the production of 9C beams (as CO molecules). In addition, ^{52}Fe and ^{48}Cr beams were delivered from the Y_2O_3 target equipped with a hot plasma ion source. The doctoral thesis work of Sandrina Fernandes, which covers the development of these nano-structured materials for radionuclide production, was awarded the Young Scientists Award from the European Materials Research Society.

ISOLDE Physics Report

The ISOLDE Physics Coordinator, Alexander Herlert, summarized the beam requests for the 2010 period and presented the present version of the ISOLDE Physics schedule. In the February meeting of the INTC, 5 new experiments were recommended for approval and 8 experiments were completed, thus leaving 69 active experiments for the 2010 beam period. The delivery of protons from the PS Booster started on May 3 and it is planned to stop the on-line operation on November 22. Therefore, 29 weeks of physics at ISOLDE are foreseen in the schedule. 50 of the active experiments requested beams with in total 627.5 RIB shifts, from which 350 RIB shifts require RILIS operation and 333 are dedicated to REX-ISOLDE. In addition, 40 RIB shifts were requested for target and ions-source development, Letters of Intent and other beam tests.

The present schedule comprises 469 RIB shifts with 432 RIB shifts for 41 approved ISOLDE experiments with in total 74 different beams and 3 dedicated on-line runs for target and ion-source development. From 25 active REX-ISOLDE experiments 17 requested beam and 11 of those experiments were scheduled this year. It is planned to have in total 28 target units - some of them will be reused or are targets from previous years - and 10 of those are new UC targets. One UC target unit will be equipped with high-density UC which should be ready for tests in November 2010. So far 14 RILIS runs are planned and the total duration of RILIS operation will be above 2000 hours. It is planned to test a RILIS scheme for astatine.

A brief overview on the first on-line runs was given: The test of a new target for samarium beams using RILIS and suppression of surface ions was not successful. Further tests are planned this year if possible. Other runs included the application of the Y_2O_3 target with a hot plasma ion source which showed promising yields of iron and chromium isotopes. However, a strong stable contamination was present as well, which hampered the physics run. The SiC target for a RILIS run for neutron-deficient magnesium isotopes was performing well and despite some vacuum problems good physics results were obtained, e.g. at COLLAPS. Similarly, a laser spectroscopy run on neutron-deficient copper isotopes was successful. However, a REX-ISOLDE run with a 9C beam from the Y_2O_3 target was not successful due to an unexpected drop in the production yield and in a subsequent run a ZrO target broke right before the start of the on-line run.

The report was concluded with a note on the change in the approval procedure for INTC experiments. It is foreseen that all INTC proposals have to include a so-called safety file which gives detailed information on the safety aspects of the setups to be used. In order to better address technical problems and safety issues, a local technical committee will be put in place which should evaluate the submitted proposals prior to the scientific evaluation by the INTC. The final approval of recommended experiments at the CERN Research Board is subject to an existing and approved safety file. More information will be given at the next meeting.

Finally, since this is the last INTC meeting as the ISOLDE Physics Coordinator, Alexander Herlert thanked all INTC members and acknowledged the support from the ISOLDE technical group and the ISOLDE physics group. He also thanked all ISOLDE Users for their cooperation

and support in the last years. He closed his report by introducing Magdalena Kowalska who will take over as ISOLDE Physics coordinator and INTC Scientific Secretary in October 2010.

Report on n_TOF

The Spokesperson of the n_TOF Collaboration, Enrico Chiaveri, gave a status report on the n_TOF facility. The latest milestones after the commissioning of the new target in 2009 were the successful installation of a Work Sector Type A and the application of borated water as moderator. The Work Sector Type A was required due to the limitation for open sources (1 LA) and the need for a special container which hampered the experiments. With the Work Sector Type A in place, there are no further restrictions for the use of actinide samples, which can be placed directly in vacuum without an additional container. An overview on the safety and technical requirements for the Work Sector Type A was given, including the installation of a dedicated ventilation system and a changing room for personnel and material. Due to the new safety regulations a special training for the access to the n_TOF experimental area is required.

The application of borated water had an expected effect on the photon energy distribution, e.g. the appearance of a 470 keV line from the reaction $^{10}\text{B}(n,\alpha)^7\text{Li}$ and the reduction of the 2.2 MeV line from $^1\text{H}(n,\gamma)$. It was stressed that the target cooling circuit and the moderator circuit are decoupled and work independently.

The alignment of the second collimator, by looking directly at the spallation target, showed that the first collimator was misaligned and a correction increased the neutron flux by 20% with respect to the 2009 running period. Furthermore, the observed flux is in good agreement with simulations, i.e. the alignment of the n_TOF beam line is well under control. The neutron flux measured in 2010 was compared with data from 2009. For neutron energies below 1eV a reduction of about an order of magnitude was observed as a result of thermal neutrons absorbed by the borated water.

Concerning safety it was reported that safety files have been created for the whole n_TOF facility, including information on the operation and decommissioning as well as all procedures, and the n_TOF detectors. For the latter, each system has its own safety or it will be available soon.

The report was concluded with an overview on the measurements planned in 2010. In total 1.02×10^{19} protons on target will be distributed for the start-up, commissioning, and data taking. The samples which require the Work Sector Type A will be scheduled as the first priority.

The following proposals for n_TOF were then presented:

- 1. CERN-INTC-2010-038 and INTC-P-209-ADD-1**, *Extension to experiment INTC-P-209: Angular distributions in the neutron-induced fission of actinides*, Laurent Tassan-Got
- 2. CERN-INTC-2010-042 and INTC-P-280**, *Measurement of the fission cross-section of ^{240}Pu and ^{242}Pu at CERN's n_TOF Facility*, Marco Calviani

Report on HIE-ISOLDE

The HIE-ISOLDE project leader, Yacine Kadi, gave an overview on the present status of the HIE-ISOLDE project. The project organization was outlined with the HIE-LINAC construction and the design study for the higher intensity of the proton driver as main parts. The work breakdown structure and the management and communication structure were described in detail. Besides the technical coordination a HIE-ISOLDE physics coordination group will be put up in order to act as a link between the user community and the technical working groups. The Steering Committee will be chaired by Mark Huysse from Leuven.

For the material budget 4.8 MCHF have already been spent and the total remaining budget at the time of the INTC meeting is 35 MCHF for the period 2010-2015 which will be shared between external funding and CERN. The external funding will mainly cover the HIE-LINAC parts, while the CERN budget will be used for the infrastructure, the design study and safety issues. For the personnel, 105 FTEs have been defined for the 5 years of the project, which will be covered by CERN staff. In addition, 70 FTEs are required which will be paid by from the department budget, by the ISOLDE Collaboration and 56 FTEs will be financed by the ITN Marie Curie Contract (CATHI proposal, ranked 3rd out of 863 submitted proposals).

An overview on the status of external funding was given. The main contributions come from the K.U. Leuven, the ISOLDE Collaboration, Swedish, British and German funds as well as a special technical training program funded by Spain. Further applications have been submitted in Scandinavia, Korea (within the KoRIA project) and Spain.

The schedule of the HIE-ISOLDE project was outlined with its start in January 2010. It is foreseen to have an energy upgrade to 5.5 MeV ready in 2014. First cavity tests have already been performed at TRIUMF and further tests are planned. Presently, the layout of the HIE-ISOLDE facility is discussed in order to start construction of the required infrastructure and new beam lines. Also the possibility of a future extension of the experimental area was presented, e.g., the installation of a storage ring at HIE-ISOLDE.

Closing remarks

The INTC Chairman thanked the ISOLDE Physics Coordinator, Alexander Herlert, for his work as INTC Scientific Secretary in the last three years.

OPEN SESSION (part 2)

Wednesday 23 June 2010 at 13:30-19:55 h, Council Chamber

The Chairman of the INTC, Peter Butler, opened the second part of the open session and announced the agenda.

The following Letters of Intent for HIE-ISOLDE were then presented:

- 1. CERN-INTC-2010-020 and INTC-I-089, *Transfer Reactions and Multiple Coulomb Excitation in the ^{100}Sn region***, Joakim Cederkall
- 2. CERN-INTC-2010-021 and INTC-I-090, *β -delayed spectroscopy of laser-polarized beams***, Deyan Yordanov

3. **CERN-INTC-2010-022 and INTC-I-091**, *Measurements of octupole collectivity in odd-mass Rn, Fr and Ra isotopes*, Peter Butler
4. **CERN-INTC-2010-024 and INTC-I-093**, *Magnetic moment measurements in $A \sim 140$ Te, Xe, Ba and Ce isotopes using the Transient Field technique*, Andrea Jungclaus
5. **CERN-INTC-2010-025 and INTC-I-094**, *Elastic resonance scattering study with a ^{20}Mg beam: $p(^{20}\text{Mg},p)^{21}\text{Al}$* , Karsten Riisager
6. **CERN-INTC-2010-026 and INTC-I-095**, *Transfer induced fission of heavy radioactive beams*, Martin Veselsky
7. **CERN-INTC-2010-027 and INTC-I-096**, *Shape studies in the neutron rich $N \sim 60$ region*, Dennis Mucher
8. **CERN-INTC-2010-029 and INTC-I-097**, *Single-Particle Evolution and Test of Shell Models*, Sean Freeman
9. **CERN-INTC-2010-030 and INTC-I-098**, *Time-reversal studies of (α,p) reactions in X-ray bursts*, David Jenkins
10. **CERN-INTC-2010-031 and INTC-I-099**, *A HELIcal Orbit Spectrometer (HELIOS) for HIE-ISOLDE*, Sean Freeman
11. **CERN-INTC-2010-032 and INTC-I-100**, *Spectroscopy of neutron-rich Ni, Cu and Zn isotopes near ^{68}Ni and ^{78}Ni using transfer reactions in inverse kinematics*, Riccardo Orlandi
12. **CERN-INTC-2010-033 and INTC-I-101**, *Exploration of K-isomerism using unique high-K isomeric beams*, David Jenkins
13. **CERN-INTC-2010-034 and INTC-I-102**, *Shape changes and proton-neutron pairing around the $N=Z$ line*, David Jenkins
14. **CERN-INTC-2010-035 and INTC-I-103**, *Studies of isospin symmetry and mirror nuclei*, David Jenkins
15. **CERN-INTC-2010-036 and INTC-I-104**, *PARIS: A high-resolution scintillator array for medium- and high-energy gamma rays*, David Jenkins
16. **CERN-INTC-2010-039 and INTC-I-106**, *Study of quadrupole-collective isovector valence-shell excitations of exotic nuclei at HIE-ISOLDE*, Norbert Pietralla
17. **CERN-INTC-2010-040 and INTC-I-107**, *In-beam electron spectroscopy at HIE-ISOLDE*, Janne Pakarinen
18. **CERN-INTC-2010-041 and INTC-I-108**, *Transfer reactions at the driplines*, Karsten Riisager

19. **CERN-INTC-2010-043 and INTC-I-109**, *Nuclear-structure evolution from ^{68}Ni towards ^{78}Ni studied with multiple Coulomb excitation*, Piet van Duppen
20. **CERN-INTC-2010-044 and INTC-I-110**, *Shape coexistence in the neutron-deficient region around $Z=82$ studied via Coulomb excitation and few-nucleon transfer reactions*, Piet van Duppen
21. **CERN-INTC-2010-045 and INTC-I-111**, *Coulomb excitation and nucleon transfer reactions in the ^{132}Sn region*, Thorsten Kröll
22. **CERN-INTC-2010-046 and INTC-I-112**, *Studies of collectivity and single-particle behaviour in Te nuclei above the $N=50$ shell gap*, Tuomas Grahn
23. **CERN-INTC-2010-047 and INTC-I-113**, *A Spectrometer for Nuclear Reaction Studies at HIE-ISOLDE*, Gry Tveten
24. **CERN-INTC-2010-048 and INTC-I-114**, *Shape Transition and Coexistence in Neutron-Deficient Rare Earth Isotopes*, Andreas Gørgen
25. **CERN-INTC-2010-049 and INTC-I-115**, *Searches for permanent electric dipole moments in Radium Isotopes*, Lorenz Willmann
26. **CERN-INTC-2010-050 and INTC-I-116**, *Study of the nature of the low-lying strength in nuclei with neutron skin*, Marc Labiche
27. **CERN-INTC-2010-051 and INTC-I-117**, *Moments, Spins and Charge Radii Beyond ^{48}Ca* , Mark Bissell
28. **CERN-INTC-2010-052 and INTC-I-118**, *GASPARD at HIE-ISOLDE*, Marc Labiche
29. **CERN-INTC-2010-053 and INTC-I-119**, *Direct and resonant reactions using an Active Target*, Riccardo Raabe
30. **CERN-INTC-2010-054 and INTC-I-120**, *Direct measurements in the rp -process with active-target detectors*, Manuel Caamaño
31. **CERN-INTC-2010-055 and INTC-I-121**, *Innovative radioisotopes for preclinical and clinical studies in nuclear medicine*, Ulli Köster
32. **CERN-INTC-2010-056 and INTC-I-122**, *High Energy Actinide Beams for Fission Yields Studies in Inverse Kinematics (FYSIK)*, Fanny Rejmund
33. **CERN-INTC-2010-057 and INTC-I-123**, *Masses of r -process waiting-point nuclides*, Susanne Kreim
34. **CERN-INTC-2010-058 and INTC-I-124**, *Post-accelerated polarized beams at the REX-LINAC*, Michael Hass

CLOSED SESSION

Thursday 24 June 2010 at 8:00 h, room 60-6-002

Present: S. Bertolucci, J. Billowes, Y. Blumenfeld, H. Breuker, P. Butler (Chairman), R. Catherall, E. Chiaveri, M. Doser, P.-H. Heenen, A. Herlert (Secretary), R. Julin, Y. Kadi, M. Kowalska (invited), D. Ridikas, E. Rondio, P. Roussel Chomaz, Ch. Scheidenberger, T. Stora (invited), V. Vlachoudis, U. Wahl

Apologies: P. Collier, H.-U. Habermeier, H. Leeb, N. Orr

1. INTRODUCTORY REMARKS

The Chairman opened the meeting and welcomed all Committee members. He announced the apologies from Hanns-Ulrich Habermeier, Helmut Leeb, and Nigel Orr, who have sent their comments via email. Furthermore, he welcomed Thierry Stora from EN-STI, who has been invited for the discussion of the Letters of Intent for HIE-ISOLDE as specialist for ISOLDE targets. Finally, Magdalena Kowalska was welcomed, who will take over the ISOLDE Physics Coordination and the post as INTC Scientific Secretary on October 1, 2010.

2. MINUTES OF THE LAST INTC MEETING

The minutes of the 36th INTC meeting held on 4 and 5 February 2010 were approved without amendments.

3. STATUS OF ISOLDE

The Committee was informed that for all experiments the new safety files will be prepared. For new proposals a safety file is required in order to be taken into account for the INTC meeting. Furthermore, a new expert group will be setup to review all proposals and to prepare a report for the Committee members. This will allow the Committee to better judge on technical feasibility and safety issues. The new procedure for the safety file and the expert group will start in February 2011.

The Committee noted with pleasure the successful work on the new HRS front-end and the new vacuum system. Furthermore, the target development on the nano-structured YO material, which helped to produce iron and chromium beams, was acknowledged. The more universal application of nano-structures materials had started with SiC as part of the EURISOL design study. For this proprietary technique a patent has been requested and its application for UCx targets or other materials will be studied within a work package of ENSAR.

The present situation with the EBIS cathode was seen as worrying and the Committee was informed that the ISOLDE technical group and the responsible experts have looked into the problem in detail. Further investigations of the cathode material and vacuum conditions will be performed in order to obtain more information to ensure a more reliable operation.

4. REPORT ON HIE-ISOLDE

The CATHI proposal is regarded as an important contribution to the HIE-ISOLDE project directed towards the development of Nb-sputtered cavities and required tests. The Committee also acknowledged the external funding obtained so far. The Committee was informed on the possibility to go up to 10 MeV/u for post-accelerated beams, which requires the matching funds for the completion of additional two high-beta cryo modules.

5. REPORT ON N_TOF

The Committee noted with pleasure the completion of the class A type work sector for n_TOF, which will allow the experimentalists to use actinide targets, and the successful operation with borated water. The Committee requested that at the next meeting a physics report shall be presented since the last reports had focussed on the technical issues only.

6. DISCUSSION ON LETTERS OF INTENT FOR HIE-ISOLDE

The Letters of Intent for experiments at HIE-ISOLDE presented during the second open session were then discussed. The Committee was impressed by the large number of submitted documents and the interest of many European research groups. The LOIs should help with the technical planning of the facility, give advice on required resources, future developments, and the layout of the HIE-ISOLDE experimental hall. It also provides important information which will enable the community to get a better overview on opportunities and possible experiments with HIE-ISOLDE. With respect to other new facilities like SPIRAL2 or SPES, the LOIs for HIE-ISOLDE should be judged on their scientific uniqueness. Although each LOI is seen as independent, new technical developments to be applied at HIE-ISOLDE should be grouped in the discussion for better comparison. Furthermore, the INTC should point out possible synergies between different LOIs. It was finally noted that future development in theory is required to cope with experiments and new results obtained at HIE-ISOLDE.

CERN-INTC-2010-020/I-089, *Transfer Reactions and Multiple Coulomb Excitation in the ^{100}Sn region*

This LOI proposes a wide variety of transfer reactions (single-nucleon transfer) and Coulomb excitation experiments on proton-rich nuclides of the elements tin, indium, and cadmium. At present the proposed region in the nuclide chart is difficult to study. All nuclides mentioned are of importance and the Committee had no doubts on the physics interest. However, for a full proposal a choice has to be made, since in practice it will most probably not be possible to measure all proposed nuclides. The Committee thus decided to **endorse** the LOI and suggested to indicate in a future proposal which cases are of the highest priority and why. Technically all beams are available and only the higher energy for post-acceleration is needed. The proponents should discuss in detail how the (d,n) transfer reactions will be carried out and should provide more information on the required ^4He targets and limitations with respect to other equipment like the T-REX chamber or the MINIBALL setup.

CERN-INTC-2010-021/I-090, *β -delayed spectroscopy of laser-polarized beams*

It is planned to improve the technique of collinear laser spectroscopy by application of β -delayed γ spectroscopy, which requires strong nuclear orientation produced by optical pumping. It will be possible to measure spins and parities of ground and excited nuclear states. The Committee found the physics case for the proposed region beyond $N=20$ - especially with respect to the island of inversion - of high interest. The experimental combination of beta NMR and gamma ray detection might open new possibilities for spectroscopy experiments thus the Committee **endorsed** the LOI. It was suggested to check if a better mass resolving power of the HRS mass separator is required in order to reach a better purity of the beams.

CERN-INTC-2010-022/I-091, *Measurements of octupole collectivity in odd-mass Rn, Fr and Ra isotopes*

With this Letter of Intent the investigation of the octupole correlation in odd-mass radium, francium and radon nuclei is envisaged using Coulomb excitation. The Committee found the physics case of high interest as it couples nuclear structure studies with the search for EDM and thus physics beyond the Standard Model. The application of the proposed beams is unique for ISOLDE. However, the Committee suggested that for a full proposal a more detailed description of the intrinsic nuclear structure should be given as well as the present status of experimental data available. Furthermore, the need for higher beam energies should be better justified since experiments on some neutron-rich radon and radium isotopes are already scheduled with the present REX-ISOLDE system. The Committee **endorsed** the LOI and suggested to provide a priority list of the proposed nuclides with respect to the EDM search.

CERN-INTC-2010-024/I-093, *Magnetic moment measurements in $A \sim 140$ Te, Xe, Ba and Ce isotopes using the Transient Field technique*

This LOI is targeting a specific nuclear structure problem. It is planned to measure the g factor of isotopes around $A=140$ using the transient field technique. To this end a higher energy of the post-accelerated beams (5 MeV/u) is required with a slow extraction from the EBIS. The Committee decided to **endorse** the LOI and suggested to re-measure ^{132}Te before addressing other nuclides. It was also suggested that additional information is given on the effect of the increased detection efficiency and cross-sections on the uncertainties. In addition, further development of the ^{132}Te beam is needed to reach the required yield.

CERN-INTC-2010-025/I-094, *Elastic resonance scattering study with a ^{20}Mg beam: $p(^{20}\text{Mg},p)^{21}\text{Al}$*

It is planned to perform measurements with elastic resonance scattering using HIE-ISOLDE to reach the higher excited states in ^{21}Al in order to probe its structure. For the isotope of interest nothing is known and more experiments are possible for other nuclides. The Committee found the physics case well motivated and thus **endorsed** the LOI. However, it was suggested that for a full proposal some ideas for the possible structure of ^{21}Al shall be supplied. Furthermore, the possible application of a solid hydrogen target or the use of the ACTAR active target should be properly explored, also with respect to limitations in the count rate and possible contamination of the beam of interest.

CERN-INTC-2010-026/I-095, *Transfer induced fission of heavy radioactive beams*

This LOI aims at the investigation of fission after nucleon transfer. The Committee acknowledged the recent results obtained for neutron-deficient thallium isotopes and found the proposed experiment an interesting way to study fission. The Committee thus decided to **endorse** the physics case. However, it was suggested that a full proposal should clarify how the fission products will be identified and what energy (mass) resolution is required.

CERN-INTC-2010-027/I-096, *Shape studies in the neutron rich $N \sim 60$ region*

With this LOI the onset of deformation and shape coexistence shall be explored in the region around $N=60$ using Coulomb excitation and transfer reactions with MINIBALL and post-accelerated beams from HIE-ISOLDE. The Committee noted that the behavior in that mass region is not well understood with respect to theoretical models. However, it was not clear what

new information can be obtained from the measurements. The Committee decided to **endorse** the LOI but stressed that for a full proposal the physics case shall be defined more clearly and it shall be better explained why HIE-ISOLDE is needed.

CERN-INTC-2010-029/I-097, Single-Particle Evolution and Test of Shell Models

The Letter of Intent addresses the issue of changing nuclear structure, i.e. single-particle energies, in heavy nuclei as well as neutron-rich calcium isotopes. Most of the requested beams are uniquely available at ISOLDE and the higher beam energy provided by HIE-ISOLDE is necessary. The experiment also requires the application of a ^4He target to perform the planned reaction studies. The Committee suggested that in a full proposal the technical feasibility and status as well as limitations with respect to target thickness and the required energy and angle resolution should be discussed in more detail. Also the application of a spectrometer for fragment identification needs to be addressed. Finally, a more detailed discussion on the theoretical aspects should be provided in a full proposal. The Committee decided to **endorse** the LOI and recommended to focus on selected cases of the very diverse experimental programme.

CERN-INTC-2010-030/I-098, *Time-reversal studies of (α,p) reactions in X-ray bursts*

It is planned to perform (α,p) reaction studies at MINIBALL in order to study nucleosynthesis in X-ray bursts. Due to the small cross sections, the time-reversed process shall be investigated. The group has a strong experience with this kind of experiments and the physics case is of high interest. HIE-ISOLDE is mandatory to reach the required higher energies. The Committee **endorsed** the LOI and pointed out that some beam development is needed, which shall be discussed before the submission of a full proposal.

CERN-INTC-2010-032/I-100, *Spectroscopy of neutron-rich Ni, Cu and Zn isotopes near ^{68}Ni and ^{78}Ni using transfer reactions in inverse kinematics*

The single-particle structure near the N=40,50 region shall be explored by use of transfer reactions, for which the higher beam energies from HIE-ISOLDE are beneficial. The Committee regarded the physics case as clearly motivated and decided to **endorse** the LOI, but it was pointed out that the purity of the beams of interest might not be suitable and further development has to be discussed with the ISOLDE technical group. Furthermore, a full proposal should explain in more detail how the spectroscopic information will be retrieved in the experiment and what kind of spectrometer is needed.

CERN-INTC-2010-033/I-101, *Exploration of K-isomerism using unique high-K isomeric beams*

The proposed measurements aim at the investigation of a well known isomer with interesting properties. The Committee found the physics case of interest, which is a more focused rather than a large scale programme. While the uniqueness of the ISOLDE beams is not questioned, the technical feasibility should be discussed with the ISOLDE technical group before a full proposal will be submitted. Hafnium beams have already been provided as molecules, which need to be broken up in REX-EBIS for subsequent post-acceleration. Since another Letter of Intent has been endorsed which aims at the development of hafnium and lutetium beams, the Committee decides to **endorse** the LOI.

CERN-INTC-2010-034/I-102, *Shape changes and proton-neutron pairing around the $N=Z$ line*

The Letter of Intent proposes the use of single particle transfer to explore pairing effects in the $N=Z$ region. The Committee regarded the physics of interest and relevant to attack the question how pairing plays a role in $N=Z$ nuclei. The beams are unique to ISOLDE but further elaboration on the identification of particles is required and the type of spectrometer used should be specified. It was also noted that proton-neutron pairing is sometimes masked by other effects and transfer reactions are the best way to investigate this phenomenon. The Committee **endorsed** the LOI and suggested that reaction calculations should be tested before running the experiment.

CERN-INTC-2010-035/I-103, *Studies of isospin symmetry and mirror nuclei*

It is planned to study isospin symmetry in mirror nuclei using Coulomb excitation and transfer reactions. The Committee noted that the envisaged results are not always easy to disentangle from other effects and that it is difficult to extract direct information from the experiment. Thus it was recommended that these aspects should be elaborated in a full proposal. Nevertheless, the Committee decided to **endorse** the LOI and stressed the feasibility of a step-by-step realization of the measurement programme with the final determination of spectroscopic factors when beams of 10 MeV/u are available.

CERN-INTC-2010-039/I-106, *Study of quadrupole-collective isovector valence-shell excitations of exotic nuclei at HIE-ISOLDE*

The aim of this Letter of Intent is to clarify the influence of the single-particle structure on mixed-symmetry states. Two mass regions are proposed, Zn-Kr and Xe-Sm, to look for signatures of mixed-symmetry states which are sensitive to p-n interactions and shell structure. It is planned to use Coulomb excitation measurements, e.g., at MINIBALL with a carbon target. For the population of the one-phonon states the higher energies of post-accelerated beams at HIE-ISOLDE are required. The Committee found the physics case well motivated and the experiments could lead to the first observation of mixed-symmetry states in radioactive nuclei. However, it was pointed out that the proponents used one theoretical model only. Mixed-symmetry states are very specific to the IBA model and it was suggested that connections to other models should be looked into. The Committee **endorsed** the LOI but asked to include a more thorough discussion in terms of theoretical models if a full proposal is to be submitted.

CERN-INTC-2010-041/I-108, *Transfer reactions at the driplines*

With this Letter of Intent it is planned to explore the structure of heavy lithium isotopes using single and two-neutron transfer reactions. This requires the HIE-ISOLDE energy upgrade as well as an increase of the ^{11}Li production yield. The Committee noted that with the expected low rate of a few hundred per second for the post-accelerated beam the experimental result might be marginal. Furthermore, the yield obtained at ISAC-2 at the TRIUMF facility is more than competitive and thus the uniqueness is not fulfilled. Since the physics case is of high interest, the Committee decided to **endorse** the LOI, however, with strong reservations with respect to the feasibility and uniqueness. For a full proposal these points have to be addressed in addition to a more detailed discussion of experimental details such as the detection of neutrons.

CERN-INTC-2010-043/I-109, *Nuclear-structure evolution from ^{68}Ni towards ^{78}Ni studied with multiple Coulomb excitation*

The physics case of this LOI is similar to the one presented in LOI I-100. However, multiple Coulomb excitation measurements at higher energies rather than nucleon transfer are planned. The whole programme as outlined in the LOI will yield new information especially for higher lying excited states. Many cases can be addressed as soon as the energy upgrade has been completed. For the iron beams the new in-trap decay technique has to be employed. The Committee **endorsed** the LOI but suggested that a full proposal should provide a priority list for the nuclides of interest since in practice it will not be possible to attack all cases. Furthermore, the required beam purity should be discussed in more detail, for example with respect to isobaric contaminants of the elements rubidium and gallium.

CERN-INTC-2010-044/I-110, *Shape coexistence in the neutron-deficient region around $Z=82$ studied via Coulomb excitation and few-nucleon transfer reactions*

It is proposed to study shape coexistence in neutron-deficient heavy isotopes by use of one- and two-neutron transfer reactions in addition to Coulomb excitation measurements. While Coulomb excitation will profit from the higher energies provided at HIE-ISOLDE, the transfer reactions are only possible at higher energies. The Committee found the physics case of high interest and it is expected that a large amount of information can be obtained in a short and long-term perspective. The Committee decided to **endorse** the LOI but recommended to prioritize the envisaged physics programme for a full proposal.

CERN-INTC-2010-045/I-111, *Coulomb excitation and nucleon transfer reactions in the ^{132}Sn region*

It is planned to perform Coulomb excitation and nucleon transfer reactions in the region of the doubly magic ^{132}Sn . The Committee found the physics case of interest since the proposed nuclides are located in a key area of nuclear structure and are also relevant for nuclear astrophysics. However, the measurements programme is very dense and it was strongly suggested to better structure a full proposal and to make a selection of the nuclides of interest. Furthermore, part of the proposed region will be available at SPIRAL2 and therefore a full proposal should address the uniqueness and complementarity. The Committee decided to **endorse** the LOI but strongly encouraged collaboration with other experimental groups in order to join efforts.

CERN-INTC-2010-046/I-112, *Studies of collectivity and single-particle behaviour in Te nuclei above the $N=50$ shell gap*

The Letter of Intent aims at Coulomb excitation and transfer reaction measurements in the region of light tellurium isotopes. It is envisaged that information will be obtained on the single-particle structure for which a deviation to the expected trend has been observed. The Committee stressed that the proponents have experience with such kind of experiments. However, it is not clear why this mass region is special. Overall the physics case was regarded as rather weak and not well defined. The Committee decided to **endorse** the LOI **subject to a clarification** with respect to the expected output of the planned measurements and a discussion on the expected impact on theory. For a full proposal the physics case has to be worked out much better. It was pointed out that beam development is required and the Committee suggested that a joint tellurium collaboration should be formed in order to combine efforts.

CERN-INTC-2010-048/I-114, *Shape Transition and Coexistence in Neutron-Deficient Rare Earth Isotopes*

It is planned to study quadrupole moments of excited states in neutron-deficient rare earth nuclei using Coulomb excitation. The Committee noted that the same group has recently submitted a proposal, which was approved and which covers almost the same physics case. In the present LOI the higher energies provided by HIE-ISOLDE should give better cross-sections. Although the uniqueness of the requested beams is given, the physics case was regarded as moderately interesting only. Since a general interest remains, the Committee decided to **endorse** the LOI **with reservations**. It was strongly suggested to develop a stronger physics case for a full proposal.

CERN-INTC-2010-049/I-115, *Searches for permanent electric dipole moments in Radium Isotopes*

With this LOI it is planned to employ radium isotopes for the search for permanent electric dipole moments. The Committee found the physics case timely and of high interest. The proponents have a good record and high reputation in this field of research and the installation of an experimental setup would give an important contribution to the ISOLDE programme. The Committee decided to **endorse** the physics case of the LOI. The ISOLDE Physics coordinator and the ISOLDE technical group were asked to examine the floor space allocation as well as safety related issues, i.e. accumulation of activity and possible risks, and to provide the information to the proponents.

CERN-INTC-2010-050/I-116, *Study of the nature of the low-lying strength in nuclei with neutron skin*

The LOI proposes to study the distribution of the E1 strength below and above the neutron threshold in the tin isotopic chain using Coulomb excitation. It is planned to investigate the so-called Pygmy dipole resonances in very neutron-rich nuclei which exhibit a neutron skin. The Committee found the physics case of interest and suitable for HIE-ISOLDE since 10 MeV/u are needed to obtain enough strength of the Pygmy resonance with respect to the tail of giant dipole resonance. The experiment might shed more light on the physics of the neutron skin and could give information on asymmetric nuclear matter. However, the Committee showed concern on the feasibility of the experiment since giant dipole resonances have not been observed at low energies. Therefore, the Committee **endorsed** the physics case and suggested that a full proposal should give a more elaborate discussion on the feasibility, e.g., with respect to expected count rates etc., as well as a more detailed description of the experimental setup and required detectors.

CERN-INTC-2010-051/I-117, *Moments, Spins and Charge Radii Beyond ^{48}Ca*

The Letter of Intent aims at the investigation of moments, spins, and charge radii for calcium and potassium isotopes beyond the neutron shell $N=28$ using collinear laser spectroscopy. With the proposed experiment important information on nuclear structure can be obtained, which is not available up to date. In the case of potassium the proposed nuclides are an extension of an already approved experiment. The Committee thus decided to **endorse** the LOI and supported the required development towards higher beam intensity and purity.

CERN-INTC-2010-054/I-120, *Direct measurements in the rp-process with active-target detectors*

It is planned to employ active target detectors in order to measure direct proton capture relevant for the astrophysical *rp* process. The Committee found the physics case well motivated and of high interest and thus **endorsed** the LOI. However, a prioritization of the large list of isotopes of interest should be made before submitting a full proposal. Furthermore, the proponents should enquire what precision will be needed as input for the astrophysics calculations. Concerning available beams, the case of ^{76}Sr was regarded as difficult.

CERN-INTC-2010-055/I-121, *Innovative radioisotopes for preclinical and clinical studies in nuclear medicine*

This Letter of Intent aims at the detailed investigation of radionuclides for medical applications. The Committee regarded the proposed measurements as a valuable addition to the ISOLDE physics programme. Many isotopes are already available at ISOLDE and therefore the need for HIE-ISOLDE was not clear. Nevertheless, with respect to the required infrastructure the context to HIE-ISOLDE is justified. Some of the planned experiments require the operation of a class B chemical lab and shipping of more radioactive samples than presently done for ISOLDE. Furthermore, a new collection chamber for high activities has to be constructed and additional assistance and supervision from the CERN Radiation-Protection group will be needed. In conclusion, the Committee noted that in a first step the feasibility of the application of the proposed nuclides has to be studied and the present infrastructure is sufficient. It was therefore decided to **endorse** the scientific case and to support the feasibility study only.

CERN-INTC-2010-056/I-122, *High Energy Actinide Beams for Fission Yields Studies in Inverse Kinematics (FYSIK)*

The proposed measurements aim at the investigation of fission fragment yields using high-energy exotic actinide beams. These experiments will be possible due to the higher energy provided at HIE-ISOLDE. The Committee also noted that the requested beams are unique for ISOLDE and that they will be complementary to previous experiments at GSI and GANIL. The Committee strongly supported the physics case and **endorsed** the LOI. It was recommended that a ^{238}U beam should first be used for reference or test measurements in order to check the detector setup prior to an experiment with radioactive beams.

CERN-INTC-2010-057/I-123, *Masses of r-process waiting-point nuclides*

With this Letter of Intent high-precision mass measurements in the region of the major waiting point nuclei ^{80}Zn and ^{130}Cd are proposed using the Penning trap mass spectrometer ISOLTRAP. The Q values deduced from the measured masses can give a better constraint on different theoretical models. Furthermore, additional information with respect to shell structure can be obtained since both nuclides are at closed neutron shells, i.e. $N=50$ and 82 . The Committee acknowledged the installation of a new ion trap at the existing setup which is supposed to further purify the ISOLDE beam. HIE-ISOLDE is required to provide higher production yields; this would address one limiting factor for the envisaged measurements. The Committee found the physics case of interest and **endorsed** the LOI. It suggested that further information should be provided on the successful test of the isobaric purification and the increase in the production yield before submission of a full proposal.

CERN-INTC-2010-058/I-124, *Post-accelerated polarized beams at the REX-LINAC*

It is planned to produce polarized post-accelerated radionuclide beams by use of the tilted foils technique. The polarization of radionuclides is a long standing issue and recently another Letter of Intent had been indorsed to allow the proponents to start a feasibility study at REX-ISOLDE. In the present LOI the allocation of lab space is requested in order to continue the experimental efforts. The Committee found the physics case of interest; however, for a full proposal first results from the feasibility study are needed in order to better judge on the achievable polarization. Furthermore, the impact of polarized beams on the experiments is questionable. The Committee thus decided to **endorse** the technical development but stressed that no judgement on the scientific case can be done at this stage.

The following Letters of Intent are related to new instrumentation for experiments at HIE-ISOLDE. Especially the important issue of a spectrometer for HIE-ISOLDE needs to be addressed in the future. The idea of installing a storage ring at HIE-ISOLDE was communicated on short notice only and therefore cannot be taken into account here. But the Committee encouraged the submission of a Letter of Intent in order to evaluate its justification and feasibility. The Committee noted further that it cannot judge on which setup will be best for HIE-ISOLDE and rather each proposed new setup is regarded separately. For better comparison the discussion is summarized in the following:

CERN-INTC-2010-031/I-099, *A HELlcal Orbit Spectrometer (HELIOS) for HIE-ISOLDE*

It is planned to install a superconducting solenoid system with position-sensitive silicon detectors as developed at the Argonne National Laboratory. This HELlcal Orbit Spectrometer shall be employed for the detection of light ions from nuclear reactions. Its performance has already been tested and it is proposed to use this kind of device at HIE-ISOLDE. The Committee **endorsed** the LOI with respect to its physics potential, however, it was noted that the funding for the setup remains to be clarified.

CERN-INTC-2010-036/I-104, *PARIS: A high-resolution scintillator array for medium- and high-energy gamma rays*

The PARIS project aims at the construction of a gamma-ray calorimeter which will be composed mainly of lanthanum bromide scintillator material in order to obtain a better detection efficiency. PARIS is suitable for the detection of high-energy gamma rays which is essential for light nuclei due to high transition energies. It is foreseen to couple PARIS to the GASPARD setup for the application for transfer reactions. The Committee regarded the proposed setup as of high interest and therefore **endorsed** the LOI.

CERN-INTC-2010-040/I-107, *In-beam electron spectroscopy at HIE-ISOLDE*

This Letter of Intent describes an electron spectroscopy setup which would be beneficial for many HIE-ISOLDE LOIs presented at this meeting. Therefore the Committee regarded the LOI as of high interest and supported the exploration of its potential and further development with respect to an application at HIE-ISOLDE. The LOI was **endorsed** and the Committee recommended that simulations should be performed as well as off-line test measurements (not necessarily at ISOLDE) including studies of the background. The results from the tests and off-line studies should be evaluated before submission of a full proposal.

CERN-INTC-2010-047/I-113, *A Spectrometer for Nuclear Reaction Studies at HIE-ISOLDE*

With this Letter of Intent the idea of developing a spectrometer for HIE-ISOLDE is discussed. The Committee noted that the ISOLDE User community needs to define the characteristics for such a spectrometer, including a proposal for the concept which fulfils the requirements best. Unfortunately, the present LOI was found to be too generic with not much detail. Since it is clear that a spectrometer is needed, the Committee **endorsed** the LOI.

CERN-INTC-2010-052/I-118, *GASPARD at HIE-ISOLDE*

This Letter of Intent describes the silicon telescope array GASPARD which will be used at SPIRAL2 in conjunction with gamma-ray arrays for nucleon transfer studies. Since it is designed as a transportable system, the application at HIE-ISOLDE is possible. The Committee found the experimental setup of high interest and therefore **endorsed** the LOI. However, it was stressed, that GASPARD is not compatible with the MINIBALL experiment and a combination with the scintillator array PARIS should be discussed (see LOI I-104).

CERN-INTC-2010-053/I-119, *Direct and resonant reactions using an Active Target*

It is planned to employ a gas-filled target which can act at the same time as a detector, e.g., in the case of (d,p) reactions. The Committee found the physics case very strong and recommended the application at HIE-ISOLDE. The LOI was **endorsed** and it was further pointed out that the development of systems like MAYA is ongoing and the required electronics is costly.

7. DISCUSSION ON N_TOF DOCUMENTS

The n_TOF proposals presented during the first open session, a memorandum, as well as letters of intent were then discussed:

CERN-INTC-2010-038/P-209-ADD-1, *Extension to experiment INTC-P-209: Angular distributions in the neutron-induced fission of actinides*

The Committee noted that there is almost no information available on the angular distribution in neutron-induced fission beyond 10 MeV. Furthermore, the angular distribution is an important correction in the measurement of fission cross sections and thus gives additional information on the fission process itself. With the availability of a Work Sector Type A at the n_TOF facility, measurements on the isotopes ^{234}U and ^{237}Np will become possible. Both are of high interest for nuclear energy applications. However, the Committee showed concern on how sufficient the collected statistics will be to conclude on the so far controversial domain where data from single-neutron induced fission is very different from proton-induced fission. It was suggested that theoretical support is sought and the proponents were encouraged to obtain better statistics for selected isotopes rather than to aim at a large physics programme which may be inconclusive. The Committee therefore **recommended** for approval by the Research Board 5×10^{17} additional protons for the experiment nTOF14 in order to reach a total number of allocated 2×10^{18} protons on target, but it was stressed that the allocation of beam time should be used to finish the data taking on ^{232}Th before attacking the case of ^{237}Np .

CERN-INTC-2010-042/P-280, *Measurement of the fission cross-section of ^{240}Pu and ^{242}Pu at CERN's n_TOF Facility*

With this proposal it is planned to measure fission cross sections of plutonium isotopes $^{240,242}\text{Pu}$ at the n_TOF facility. The Committee found the physics case of ^{242}Pu well motivated and easy

to justify. The expected results should allow one to draw a conclusion both in the region of low and high energies. The case of ^{240}Pu was regarded as less convincing, however, data are still required and thus it was also supported. The Committee also noted that MicroMegas detectors will be used for the actual data taking. It was decided to **recommend** for the approval by the Research Board a total of 8×10^{18} protons on target.

CERN-INTC-2010-023/I-092, *Micromegas performance test for (n, α) measurements at n_TOF : $^{33}\text{S}(n, \alpha)$ cross section*

It is planned to perform test measurements with the new neutron detectors based on the MicroMegas concept. The measurements will be possible in parasitic mode, i.e., no additional protons will be needed and thus an efficient use of the allocated protons can be achieved. The Committee **endorsed** the physics case, which is related to astrophysics, and encouraged the proponents to submit a full proposal once the results of the detector tests are available. For the tests a total of 1×10^{18} protons on target are required.

CERN-INTC-2010-028/M-016, *Neutron capture cross section measurements of ^{238}U , ^{241}Am and ^{243}Am at n_TOF*

The Committee found the physics case of high interest since the capture cross section of ^{238}U is very important in new generation nuclear systems, in particular in the case of fast breeder reactors. The accuracy of the data to be obtained has to be rather high ($<3\%$) and therefore a long measuring period was originally requested. The physics case has already been endorsed in the June 2009 meeting of the INTC and part of the envisaged programme approved as experiment nTOF15. With the improved working conditions for actinide targets, i.e. having a Work Sector Type A in place, it should be possible to perform these measurements in the next campaigns. The Committee **recommended** for approval by the Research Board an additional 6×10^{18} protons to reach a total number of 1.4×10^{19} protons on target as initially requested for the experiment nTOF15.

CERN-INTC-2010-037/I-105, *Validation of simultaneous measurement of capture and fission reactions at n_TOF*

This letter of intent aims at the experimental validation of a simultaneous capture and fission measurement combining the Total Absorption Calorimeter and three MicroMegas detectors equipped with thin ^{235}U samples. The Committee noted that the proposed feasibility experiment is of high priority and that a successful test would open the way to new experiments of high importance with respect to waste transmutation issues. Therefore, the Committee decided to **endorse** the physics case and supported a test run which requires the allocation of 7×10^{17} protons on target.

At the very end, it was finally pointed out that it can be questioned if PPAC measurements should be continued for fission cross section measurements or if new MicroMegas detectors are superior, i.e. they allow one to perform more precise measurements without additional corrections for efficiency. Further clarification in terms of complementarities for both approaches, including theoretical support, could help to find a conclusion.

8. A.O.B.

The Chairman thanked Patricia Roussel Chomaz for her work and effort as INTC member. She will be replaced by Navin Alahari from GANIL at the next meeting. Peter Butler also thanked Monique Budel, who will retire, for all the work she has done in the last years for the INTC.

Finally, as already mentioned in the open session, the Committee acknowledged the work done by Alexander Herlert, who steps down as ISOLDE Physics Coordinator and INTC Scientific Secretary in September 2010. Magdalena Kowalska will take over at the next meeting.

9. DATES OF NEXT MEETING

The next INTC meeting will take place on **Thursday 4 and Friday 5 November 2010**. The deadline for submission of documents is **Friday 8 October 2010**.

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