Minutes of the meeting of SPIRAL2 Scientific Advisory Committee (SAC) held in Giens on September 11th, 2009

Present: N. Alamanos, B. Blank, G. De Angelis, W. Gelletly, D. Guillemaud-Mueller, M.N. Harakeh (Chair), W. Henning, W. Mittig; ex-officio: N. Alahari, S. Galès, M. Lewitowicz

Absent with notification: F. Iachello, B. Jonson, T. Motobayashi, H. Stöcker, D. Vernhet

The SPIRAL2 SAC met on Friday, September 11th in Giens. This was on the last day of the GANIL Colloque, which was held from 7 to 11 September in Giens. In the morning, the open session was held in which presentations of the letters of intent (LoIs) for day-one experiments were made by the S3 and NFS collaborations. Status reports of S3, NFS, GASPARD and PARIS projects were also presented. See Annex 1 for a detailed programme. F. Azaiez gave also a report on the activities of the Instrumentation Coordination Committee (ICC) and the HI-RIB working group.

Status reports of the instrumentation projects, which were presented in the open session and those that were not presented, were considered together with the 16 LoIs for day-one experiments that were submitted by the S3 and NFS collaborations. The reports on these various instrumentation projects and the LoIs are given below. Here, it should be remarked that a general concern for the LoIs is whether the targets proposed for the experiments could withstand the high beam intensities that would be delivered by LINAG. Although at the S3 workshop earlier, mention was made of preparation of the actinide targets, the SAC advises the groups to look seriously into this question, and develop the target assembly that can survive the extreme conditions of beam target-heating.

Closed session

At the beginning of the closed session Marek Lewitowicz gave a presentation on behalf of Marcel Jacquemet, who could not attend the meeting because of other commitments. Marek discussed the progress made with the SPIRAL2 project and informed the SAC of the steps that need to be taken before commencing with the construction of the building for SPIRAL2. The presented status of the SPIRAL2 Project was focussed, in connection with the evaluation of the letters of intent, on the achievements of its Phase 1. The following major points were emphasised:

- The construction of SPIRAL2 Phase 1 is progressing according to the initial schedule with some minor delays not exceeding 2-3 months.

- The safety records were elaborated and submitted to the French Safety Authorities on April 30th, 2009. A construction permit is expected to be granted by the authorities at the beginning of 2010.

- Preliminary design of the Phase 1 buildings elaborated by the INGEROP Company was validated on July 10th, 2009. It contains the final configuration of all halls, technical solutions for safety requirements (earth quake and fire, in particular), cost estimate (better than ± 15%), construction schedule and related documentation.

- An important milestone was reached in the construction of LINAG: a first mass-separated beam was measured at the heavy-ion injector assembled at Grenoble on May 20th, 2009.

- The contract for manufacturing of the SC cavities type A was signed in July 2009. The delivery and tests of the serial SC cavities type B are taking place according to schedule at IPN Orsay.

Before starting the evaluation of the LoIs and status reports, W. Mittig made the remark that his objection to the statement in the previous report: "The management has presented its timeline regarding the accomplishment of the various stages of the SPIRAL2 project as well as the safety issues that have to be resolved in order to ensure a smooth execution of the project." was not intended for the SPIRAL2 project proper. His concern about the safety issues was rather intended for the DESIR facility. S. Galès assured the SAC members that safety is taken very seriously by the project management and that all experimental halls, including DESIR, will have to satisfy the national radioprotection and safety laws before being given the permission to accept beams from SPIRAL2.

LoI_Day1_1: Fast ion-slow ion collisions - FISIC project
E. Lamour *et al.*

The SAC found the scientific motivation of this project well documented and convincing. It addresses physics problems which are of intrinsic fundamental interest in an energy domain where no data exists. This is of great interest to understand the mechanisms underlying these collisions and to compare with theoretical models. Furthermore, these studies will have applications in various domains of science. SPIRAL2 will be unique to perform experiments of this type. However, the experiments are challenging because of their demands on high beam quality and time structure as well as on the ultra high vacuum near the interaction zone. It has been shown in the past that difficult technical problems with achieving an ultra high vacuum could be solved at LISE. The requirements on the beam quality and time structure could be achieved in close collaboration with the SPIRAL2 and S3 teams.
It is of interest for GANIL to have users of the SPIRAL2 facility by a community from outside of the nuclear physics domain. The experiment proposed by this collaboration needs a quite complex installation in the S3 hall. The SAC recommends the realisation of this experiment as soon as possible, without blocking the S3 device in the starting period. This is about one year after the commissioning of S3, and the SAC invites the collaboration to make a detailed proposal.

LoI_Day1_2: Production and spectroscopy of heavy and super-heavy elements using S3 and LINAG
P. Greenlees, K. Hauschild, A. Korichi, Ch. Theisen, S. Christelle *et al.*

This LoI proposes production and spectroscopic studies of heavy and super-heavy nuclei. Indeed, the high beam intensities predicted for SPIRAL2 and the S3 reaction-product filter plus mass spectrometer provide a unique opportunity for the study of these difficult to produce, and often extremely rare events.

But in the high intensities expected from SPIRAL2, there also lies the challenge and drawback: the expected total target-reaction rates will be so high that the most effective approach to

spectroscopy, in-beam gamma ray studies, will not be fully possible. This is implicitly recognised by the LoI in the sense that for all spectroscopic studies the decays of isomeric states (both in gamma decay and in some favourable cases also in isomeric alpha decay) is initially proposed. This, of course, severely limits the range of spectroscopic results one can expect. But it is indeed the only area of immediate spectroscopic studies which will be possible with the full beam intensities from SPIRAL2 (other than just reaction product observation).

Nevertheless, this still provides for unique opportunities in spectroscopy in these heavy and largely unexplored nuclei. An obvious comment up front: the proposed scope of experiments and requested beam time of more than 150 days of beam on target presented in this LoI, in no way represent a "day-one" proposal. The choice of initial studies has to be much more selective, needs to be justified on a detailed science case basis, and to be worked out in much detail regarding, e.g., expected rates and isotopes that can be reached in the various studies (some of that is indicated already, but much more work and experimental simulation is necessary for the future day-one proposals to be credible).

The LoI addresses four areas of studies ("cases"). The first - *study of shell-model states around Z = 92, N = 126* – is very timely (at present), and alludes to interesting nuclear structure questions. One might, however, expect that some, or possibly a large fraction, of these questions will have been addressed and possibly resolved at other facilities by the time SPIRAL2 comes on-line. So this has to be monitored carefully by the collaboration and, at the appropriate time, the cases of largest interest that have not yet been addressed, need to be proposed for, and pursued by, the SPIRAL2 programme.

The second area – *study of K-isomerism in the region above Z = 100* – has a better chance of yet still being unexplored when SPIRAL2 comes on-line, but it also has much more severe requirements on beam intensity and background reduction. In the proposed region of deformed nuclei, low-lying transitions are highly converted and pose an additional threshold for observation and spectroscopy. Again, one needs to carefully select one promising reaction and isotope(s) (Rf, Db?) and focus on its spectroscopy as a day-one experiment. The considerable range of systematic measurements that are proposed obviously represent a programme for several years of research and have to be carefully worked out as the programme progresses. For a day-one experiment one system needs to be initially selected, worked out and prepared.

This applies even more to area three – *very heavy and super-heavy studies with asymmetric reaction (Z = 105-107).* This means the use of transuranium targets and intense beams of somewhat lighter isotopes (O to Ne). It opens a new region for spectroscopy, with somewhat higher production rates expected – despite the fact that these are "hot-fusion" reactions – due to the smaller dynamical inhibition of compound nucleus formation. Again, for a day-one experiment one system needs to be initially selected and carefully prepared, in particular since the indicated studies rely heavily on transuranium targets. The target issues under high beam intensities will be the most critical aspect in this respect, requiring substantial development and attention.

The latter is even more obvious for the fourth area – production *of super-heavy elements with Z = 106, 108 and 112.* For the heaviest systems it is proposed to use uranium targets and somewhat heavier beams, Si to Ca, i.e. again in "hot fusion" reactions, which will provide possibly access to

new isotopes, bridging the gap between "cold" and "hot" fusion products. This is very important because it might anchor the yet "floating" super-heavy isotope island discovered in Dubna. The mass spectrometer capabilities provide very important and unambiguous mass (or m/q) determination. This is important for the particular cases addressed in this fourth programme, but of course also for all the other cases discussed.

Overall this is a very exciting (and very broad and long-term) programme that is laid out here. Clearly it reaches far beyond day-one experiments. So for all areas of study proposed here it is important to work out in detail the specific day-one cases that are a good compromise between being scientifically exciting but also technically feasible.

LoI_Day1_3: In-source resonant laser ion spectroscopy of ^{94}Ag
LoI_Day1_4: In-source resonant laser ion spectroscopy of the light Sn isotopes A = 101-107
LoI_Day1_5: In-source resonant laser ion spectroscopy of $Z \geq 92$
I.B. Darby *et al.*

These three letters of intent have the common feature of using a gas cell placed at the low energy branch at the S3 and connected via the mass separator to the DESIR hall. The setup will be a sort of an "experimental facility in the facility". Major work on the realisation of the equipment is performed at LISOL, Louvain-la-Neuve where the feasibility of the measurement is going to be tested. The SAC finds the physics proposed with this technique of high interest but is uncertain how easy it will be to get this experiment going as a day-one experiment.

In the following some specific comments on the three proposed measurements are given.
1- The nucleus ^{94}Ag, which has shown a lot of remarkable features, is certainly a very interesting case and if possible this case should be studied with top priority. Since a parallel development aiming to the same goal is presently going on in Jyväskylä, the SAC asks the proponents to report on it and specify their priorities. The purity of the isomeric beam is here a very important issue for the characterisation of the decay.
2- The measurements of the spins of odd-A isotopes and the mean square radii of each isotope for the sequence A = 101-107 of Sn isotopes constitute a very interesting subject and a normal extension of the programme around this setup is encouraged.
3- The proposed study of the ^{215}Ac seems to be an interesting first case that would be opening up a broad range of experiments on isotopes belonging to the heavy elements when the proper laser ionisation schemes would be developed.
In conclusion, these proposals can be the start of a possible vital programme. We encourage the collaboration to test the performance of the setup providing some early results from either ^{94}Ag or ^{215}Ac.

LoI_Day1_6: Single-proton states and proton-neutron interaction in ^{100}Sn
L. Caceres *et al.*

The present LoI proposes to measure the gamma decay of nuclei in the region of ^{100}Sn. Specific objective of the LoI is the identification of the excited states in ^{99,100}In and ^{99}Cd. The proposal is based on the production of a secondary ^{56}Ni beam by means of a two-neutron stripping reaction of a ^{58}Ni beam on a ^{9}Be target. The nuclei of interest are then produced by means of a successive fusion evaporation reaction on ^{50}Cr and subsequently identified. The SAC finds the physics

addressed highly interesting and the object of competing research all over the world. Concerning the estimates reported in the proposal, the SAC has some concerns regarding the value of the cross section used as well as the estimated rates and encourages the proponents to revisit this part of the LoI. Moreover, the SAC asks the proponents to specify how they think to identify the characteristic gamma lines of the nuclei of interest.

LoI_Day1_7: In-beam gamma spectroscopy of neutron-rich nuclei studied with PARIS at the intermediate focal plane of S3
I. Stefan, B. Fornal *et al.*

The physics motivation of this proposal, i.e. to study the shell structure far from stability on the neutron-rich side, is good. The proposed experimental method is to take advantage of the high intensity of the SPIRAL2 primary beams and produce neutron-rich nuclei following deep-inelastic or quasi-fission reactions. These neutron-rich nuclei will be used in secondary reactions at the mid-point focal plane of S3 to populate excited states in even more neutron-rich nuclei. In particular, the group plans to use the ^{48}Ca+^{238}U reaction in order to produce secondary beams in the vicinity of ^{44}S. These secondary beams will be used to induce secondary reactions at the mid-point of S3 in order to produce and perform spectroscopic studies of nuclei around ^{42}Si. These studies will be performed through an event-by-event identification of the final fragments using the second half of S3 and recording coincidences with gamma rays emitted from the secondary reaction products. Combination of PARIS and other Ge-based detectors is a good idea, since it allows measuring both high- and low-energy photons that coexist in the decay of the nuclei of interest. The proposal should form a good basis for more extensive future studies with this method.
As mentioned in the LoI, the cross sections near zero degree are crucial for the proposed method of producing beams for secondary reactions. The question arises if the method can compete with or is superior to other methods, like fragmentation-based exotic beams, in populating excited states with good statistics. This should be answered (in part) by some R&D studies. The SAC advises the collaboration to study the exit channel properties of the reaction ^{48}Ca+^{238}U at existing facilities. Also, theoretical developments on the reaction mechanisms are important.
Finally, the SAC wonders whether the tails of beams of other charge states will not contaminate the focal plan of S3, rendering the planned measurements difficult. The SAC asks the collaboration to investigate this point.

LoI_Day1_8: Shell structure, isospin symmetry and shape changes in $N = Z$ nuclei
G. De Angelis, B. Wadsworth *et al.*

This proposal consists of two parts:
Coulomb excitation of ^{104}Sn. The physics motivation of this part is very good and interesting. It aims to produce ^{104}Sn and study the B(E2) values through Coulomb excitation. The ^{104}Sn nuclei will be produced in the ^{58}Ni+^{50}Cr reaction. After selection through S3 the recoiling reaction products with A = 104 and a recoil energy of ~0.8 MeV/u will undergo inelastic Coulomb scattering on a ^{58}Ni target. Gamma rays will be detected with the AGATA detector.
Previously obtained results in ^{106}Sn-^{110}Sn are inconsistent not only with large-scale shell model calculations, but also with the generalised seniority scheme of Talmi and with microscopic interacting boson model calculations, all of which predict a parabolic behaviour. This experiment is crucial for a microscopic understanding of the region of semi-magic nuclei with $N \geq 50$.

Coulomb excitations of the T = 1 bands of odd-odd ^{62}Ga, ^{66}As and ^{70}Br. The physics motivation of this part, as presented in the proposal, is not stated clearly. It proposes to use reorientation effects in Coulomb excitation to study the sign of the quadrupole moments in the isobaric multiplets of the A = 70 mass region. The objective is to investigate the relation between Coulomb energy differences and shape changes in isobaric triplets. On the other hand, the structure of odd-odd nuclei in this region is of importance for several reasons: to test nuclear structure models as emphasised in Ref. [10] of the proposal; for studying T = 0 proton-neutron pairing; and, in heavier As isotopes, to provide tests for calculation of nuclear matrix elements of use in double-beta decay. This part, with a change of emphasis, is therefore also worth pursuing.
The SAC asks the collaboration to investigate the possibility of using the PARIS detector which would probably provide more flexibility in carrying out these experiments.

LoI_Day1_9: Quadrupole Moments of isomeric states using the Tilted-foils Technique at S3
G. Georgiev, M. Hass *et al.*

The SAC considered this proposed "day-one" experiment along with others. The SAC was unanimous in thinking that the proponents certainly have the expertise and experience necessary to carry out such experiments successfully. The experiments seem feasible and carry a reasonably good chance of success. However, it was felt that the goal of the experiments is expressed in very general terms and it is not clear in what way they will really illuminate our knowledge of nuclear properties. In terms of a "day-one" experiment one would want to see something that was not only likely to be successful but also likely to make an impact on the subject when published. One of the aims of such experiments must be to announce that the facility is up and running and operating successfully.
In common with suggestions to other LoIs, the group proposing these experiments should think hard about how they will ensure that their targets will withstand the beam intensity from LINAG.

LoI_Day1_10: Precision study of the superallowed beta decay of heavy odd-odd $N = Z$ nuclei
B. Blank *et al.*

Very accurate measurements of the superallowed beta decay between spin 0^+ and isospin T = 1 states have been the subject of great interest for a very long time. Data of this kind have provided a very sensitive probe for the conserved vector current hypothesis; they have set tight limits on the presence of scalar right-handed currents and given a very precise value of the V_{ud} quark-mixing matrix element of the CKM matrix. The present unitarity test on the top row is now 0.99995(61). The remaining uncertainty of the value for the sum of the squares of the top row matrix elements is mainly due to the uncertainty of the theoretical corrections. The future challenge is to expand the experiments towards heavier superallowed emitters where some of the theoretical corrections are more important. This in turn means that one may learn more about them in general from such measurements.
The present proposal aims at measuring half-lives very precisely and to determine branching ratios by studying both gamma rays and conversion electrons. There are several interesting cases proposed and the collected data will certainly be a valuable contribution to the mass measurements performed elsewhere. Without such mass measurements, however, the *ft* value cannot be obtained, and it is necessary to clarify when and where such a measurement will be done.

The experiments seem to be very suited as a day-one type of experiment: The group has the equipment needed, the experience to do this fast and will most likely be able to present relevant nuclear physics data at an early stage of the SPIRAL2 experimental programme. The difficulty of data analysis in such a precision experiment should be discussed

LoI_Day1_11: ^{100}Sn factory – studies of the structure of nuclei in the ^{100}Sn region
D. Seweryniak *et al*.

The physics motivation of this proposal, i.e. the search for the super-allowed alpha-decay chain ^{108}Xe-^{104}Te-^{100}Sn, is excellent. It addresses a long standing problem of the extent to which α-clustering is present in heavy nuclei. The nuclei chosen are the "best" cases for this study. Furthermore, the study of the region of the nuclear chart around ^{100}Sn will quite certainly be one of the highlights of the physic programme of S3. The experiments as described in the proposal are well suited to be part of the first experiments to be performed with SPIRAL2-Phase1. The collaboration is well prepared for this type of experiment, and the SAC strongly recommends these experiments to be performed in the beginning of Phase1.
The proposal is not very detailed and the proponents should provide further details, with references to previous work on the subject and to possible theoretical interpretations. As mentioned in the LoI, use of the fusion reactions proposed is unique and challenging. However, the yield estimate is crucial for the feasibility. The question is then: what is the basis of the cross-section estimates for the relevant reactions? Feasibility studies should continue. Possible collaboration with DAY1_6 and/or other related proposals may be considered.

LoI_Day1_12: Fragment angular distributions in neutron-induced fission of actinide nuclei
L. Tassan-Got, L. Audouin *et al*.

The SAC considers this a well-planned experiment and of significant merit. The letter of intent proposes the measurement of fission-fragment angular distributions for neutron-induced fission of actinide nuclei. The motivation arises, on the one hand, from the limited data available from previous measurements (particularly for neutron energies above 10 MeV), the ambiguities (or limited accuracies) of the existing data, and the unexpected differences – yet with large error bars – of neutron vs. proton-induced fission-fragment asymmetries over a large energy range. On the other hand, these measurements will also provide important information on the fission mechanism, in particular with regard to the transition-state properties.
The authors argue that the SPIRAL2 NFS, in combination with the effective target-plus-detector system they propose, provides for a unique opportunity for rather precise measurements of the fission asymmetries. The SAC accepts the arguments made. In addition, it finds that the fact that the SPIRAL2 NFS is expected to have approval for experiments with actinide targets makes it unique in comparison to other neutron facilities.
The target-plus-detector system consists of a stack of thin target foils of various actinide targets inter-leafed with a stack of ten position-sensitive PPAC detectors, targets and detectors both with 45 degree inclination relative to the beam direction. This setup is considered by the SAC as a very powerful detection system for this type of measurements. It provides substantial angular acceptance and good efficiency through the multiple target array. Consideration is also given to neutron collimation to minimise background. Count rate estimates per energy bin, including efficiency, are presented which suggest that meaningful data will be obtained during the running

period requested. The accuracy of the fragment-distribution data will be significant, since it involves relative measurements, largely independent of absolute efficiency calibrations etc.
The SAC strongly endorses that the collaboration proceeds with the planning of this experiment and that a fully detailed proposal be submitted at the appropriate time.

LoI_Day1_13: Study of the pre-equilibrium process in the (*n,xn*) reaction
X. Ledoux *et al.*

Concerning the experiment entitled "Study of the pre-equilibrium process in the (*n,xn*) reaction" the SAC felt that the experiment could be carried out reliably in the early stages of the facility operation. Constraining the pre-equilibrium process through measurements of double differential cross-section is of interest for many applications like Accelerator-Driven Systems, fast-neutron reactors or medical applications. The apparatus is already ready to run and a dedicated acquisition system is prepared for the experiment.

LoI_Day1_14: Comparison between activation and prompt spectroscopy as means of (*n,xn*) cross section measurements
M. Kerveno *et al.*

The SAC considered LoI_Day1_14 in terms of both the written and oral submissions. The SAC recognises that neutron-induced reaction cross sections are of considerable importance in terms of future generations of reactors and in other contexts. The essence of the proposal is to use the unique case of ^{90}Zr(*n*,3*n*)^{88}Zr to test the method of prompt gamma-ray spectroscopy by comparing it with the total cross section determined by activation in this case where it is possible to make the comparison. The experiment is certainly feasible and the group concerned should continue to develop the idea. The SAC felt that it did not only meet the criterion of being an experiment which is just feasible but would also act, on publication, as a flagship announcing the operation of NFS at SPIRAL2.

LoI_Day1_15: Fission-fragment distributions and neutron multiplicities
M. Aïche, D. Doré, F. Rejmund *et al.*

The motivation for this experiment both from the scientific and application points of view is excellent. The experiment will provide accurate mass and kinetic energy distributions of fission fragments and neutron multiplicities following neutron-induced fission on several actinide nuclei. These data can form benchmarks for testing models. Moreover, the data subset obtained for fission induced by fast neutrons is very important for development of reactors for waste transmutation. The SAC is, however, concerned by the low total efficiency of the experimental set-up. The fragment mass distributions and their energies will be deduced from measurements of time of flight by secondary-electron detectors (SEDs) and of energies by silicon detectors, which are "conventional" techniques but the total geometrical acceptance is very small, of the order of 0.5%. The measurement of the charge of the fragments will be made by six low-energy X-ray detectors with a total geometrical efficiency of 30%. The multiplicity of X-rays is not taken into account in the discussion although internal electron conversion definitely plays a role in the decay of fission fragments. If the charges of the fragments are also to be determined, the total efficiency may be as low as 0.1%. The SAC recommends to the collaboration to look into

increasing the total geometrical efficiency of the SED + silicon detectors and to consider using ionisation chambers for *Z* determination, which may increase the total efficiency further.

LoI_Day1_16: Proton and deuteron induced activation reactions
P. Bém, M. Avrigeanu, U. Fischer, S.P. Simakov *et al.*

Them aim of these experiments is to measure p and d interaction cross sections for an ensemble of elements which are important for radioprotection calculations in the energy range from the threshold of activation up to 40 MeV.
The SAC agrees that these measurements are important and that the existing tabulated data deserve strong improvement. Teams performing radioprotection calculations for the IFMIF-EVEDA project were recently confronted with this problem.
The SAC advises the authors to contact the GANIL teams in order to verify the practical feasibility of these measurements and to ensure that it will be possible to return the irradiated foils outside GANIL for further analysis.

Evaluation of the technical status reports:

GASPARD status report:

The SAC is pleased that many of its remarks in the last SAC report were addressed and solutions have been found. In particular, the SAC is satisfied that the management structure for the GASPARD project has been resolved in a transparent way. The SAC congratulates the collaboration for the developments of the project and appreciates the efforts done to proceed toward a final design concept. The decoupling of the particle and gamma detections is certainly a considerable simplification of the future device. The SAC also appreciates the progress obtained in defining the simulation tools and encourages the proponents to perform the detailed simulations needed to finalise the design of the detector.
Synergy with HYDE or other detectors might be cost effective and lead to significant improvement of the various components and implementation of state-of-the-art technologies. Therefore, activities of the joint working group are highly encouraged. However, the SAC asks the proponents to optimise ultimately the design specifications for the SPIRAL2 working conditions which also might depend on the budget prospects.

Neutrons for science (NFS) status report:

The SAC felt that considerable progress had been made since the last report from this community. The SAC felt that it was essential that the community pushed ahead with simulations related to the collimators to be used and the neutron backgrounds which will be generated in operation. The list of actions at the end of the status report is a sensible one and this work should be carried out as soon as possible.

PARIS status report:

The SAC acknowledges the progress made by the PARIS collaboration in particular concerning the detector tests of the $LaBr_3$ prototype cubic detectors which displayed excellent resolution in

both configurations the 2″-long and 4″-long crystals. The test with the phoswich-type detector composed of $LaBr_3$ and CsI(Na) crystals is very encouraging indeed and should be quite useful in detecting high-energy γ-rays because of the high efficiency and very reasonable resolution. The GEANT4 simulations have been performed with the phoswich-type detector and it seems that the collaboration is now at the crossroad for making a choice between the cubic-like geometry and the radial-like geometry of PARIS, both consisting of rectangular phoswich crystals. The truly spherical geometry has been abandoned because of the choice of rectangular phoswich crystals. The SAC is pleased to hear that the final decision of the geometry will be made in October 2009. The SAC in its last report asked the PARIS collaboration to present in the next status report the programme focussed at SPIRAL2 (and not the full PARIS programme). Though some physics cases have been discussed which are focussed on SPIRAL2, also the heavy-ion radiative capture case was presented which can be done at tandem facilities. It would be strongly recommended that in the next status report both the GASPARD and PARIS collaborations should work out one or more experiments where the integrated GASPARD and PARIS detectors are used.

S3 status report:

The SAC recognises that the S3 collaboration has, since the last SAC review, made significant progress concerning the target area, the optical design of S3 and the magnet design. The collaboration is well organised and works hard to meet the schedule for first experiments in 2012. It was indicated to the SAC that important design decisions, such as normal- versus super conducting dipoles etc. will be made in the near future. The SAC strongly endorses the goal to expeditiously proceed with these decisions and to have a final, or near-final, design completed by the time of the next SAC meeting. In general, the SAC asks that the schedule and the milestones be regularly verified, in particular to take possible delivery delays and other problems into account. As S3 is one of the first instruments to receive beam from SPIRAL2 and a large number of day-one experiments depend on its completion, the collaboration is asked to report regularly to the SAC on the progress and any changes in the schedule for the construction, installation and commissioning of S3.

EXOGAM2 status report:

The SAC congratulates the collaboration for the developments of the project and appreciates the efforts done. The performance of the resistive preamplifier developed for the high counting rate is encouraging as well as the development of the new time-stamp event builder. Also, the efforts made for the use of position sensitivity are appreciated even if the SAC identifies in this respect a strong limitation imposed by the presence of only front-side segmentation in the crystals. The optimisation of performances and costs, including manpower, should be further sought for. The SAC is also pleased to see that there is progress in obtaining commitments from the partners in the collaboration towards design work and implementation of the changes.

ACTAR status report:

The SAC congratulates the collaboration for the developments of the project and appreciates the efforts done to proceed toward a final design concept of the new device. Also, the progress made in the organisation of the collaboration is well taken. The SAC encourages the proponents to finalise the project specifications and to proceed towards the definition of the MOU.

The **DESIR facility** status report:

The SAC acknowledges the progress made by the DESIR collaboration, in particular concerning the continuing development of the experimental set-ups to be installed in the DESIR hall from 2013 (the LUMIERE facility, MLLTRAP...). The SAC noted that the construction programme for DESIR was established in close collaboration with the SPIRAL2 team and expects in a future meeting to have the technical report together with the updated costing of the facility including the infrastructure and equipment.
The discussion in the report concerning the work delivered by one of the collaborating groups should have been carried out with the group in question separately to try to understand the reasons for any delays and find solutions together. It is clear that such statements made in a public written report can harm the spirit of collaboration between the groups participating in the construction of SPIRAL2 and should be avoided at any cost.

FAZIA status report:

In its last meeting, the SAC asked the collaboration to investigate the sensitivity of the detectors to radiation damage and to provide information concerning the full identification dynamics which was not quantitatively clear to the SAC members. The SAC requested the FAZIA collaboration to clarify these issues in a detailed status report before the present meeting.
The SAC understands that due to technical problems related to beam availability it was not possible to clarify these issues. The SAC encourages the collaboration to continue its efforts in order to clarify these issues discussed in the previous report and submit to the SAC a detailed status report in due time.

The **next meeting** of SPIRAL2-SAC will be on **Thursday, 28 January 2010** in Caen and will be part of the SPIRAL2 week, 25-29 January 2010.

The following topics are proposed to be discussed at the next SAC meeting:

- Evaluation of the status reports of the new SPIRAL2 detectors
- Follow-up of the LoIs Phase 1
- Theoretical developments for the SPIRAL2 physics
- NEDA new neutron detector for SPIRAL2
- High-power targets for the SPIRAL2 Phase 1 experiments (including radioactive targets).

Annex 1

Agenda for meeting of SAC SPIRAL2 on June 11th, 2009

Open session from 9:00 to 13:00 (3h)

9:00 S3 status report (A. Drouart) (10'+5')
9:15 S3 Day 1 exp.: Studies of heavy and very heavy nuclei (P. Greenlees) (15'+5')
9:35 S3 Day 1 exp.: Spectroscopy of medium mass nuclei (F. Azaiez) (15'+5')
9:55 S3 Day 1 exp.: Ground-state properties and fundamental interactions (I. Darby) (15'+5')
10:15 S3 Day 1 exp.: Fast ion-slow ion collisions - FISIC project (Speaker to be confirmed) (7'+3')

10:25 Coffee Break 20'

10:45 ICC report and HI-RIB working group (F. Azaiez) (15'+5')
11:05 NFS status report (X. Ledoux) (10'+5')
11:20 NFS Day 1 exp.: Cross-section measurement by in-flight spectroscopy (M. Kerveno – to be confirmed) (10'+5')
11:35 NFS Day 1 exp.: Measurement of deuteron-induced reaction cross-sections (E. Simeckova) (10'+5')
11:50 NFS Day 1 exp.: Fragment angular distributions in neutron-induced fission of actinide nuclei (L. Tassan-Got – to be confirmed) (10'+5')
12:05 NFS Day 1 exp.: Fission-fragment distributions and neutron multiplicities (D. Doré) (10'+5')
12:20 GASPARD status report (I. Martel) (15'+5')
12:40 PARIS status report (A. Maj) (15'+5')

13:00 – 14:00 Lunch

SAC Closed session from 14:00 to 18:00 (4h)