MINUTES OF THE 161st MEETING OF THE RESEARCH BOARD
HELD ON THURSDAY, 14 NOVEMBER 2002


Apologies: M. Spiro.

Items
1. Procedure
2. Reports and matters arising from the LHCC meetings of 2-3 October 2002.
4. Reports and matters arising from the SPSC meeting of 5 November 2002.
5. Any other business
1. PROCEDURE

The Director General thanked M. Delfino and J-P. Delahaye for their contribution to the work of the Research Board as Leaders of IT and PS divisions respectively and for their always appreciated and always constructive interventions. Delfino will be replaced by W. von Rueden. He also thanked H. Flocard for his work as Chairman of the INTC. During his chairmanship the ISOLDE programme has undergone significant changes and the nTOF facility has begun to produce scientific results. He will be replaced by J. Aysto. Finally L. Camilleri was thanked for his work as Secretary for the past five years. He will be replaced by R. Forty who was welcomed by the Director General.

The Minutes of the Research Board held on 12 September 2002 [1] were approved with the following change:

Page 5 line 12: ….completion date of the dipole cold mass production of June 2006.

L. Evans informed the Research Board that the BRUGG cabling machine is again operational and that the cabling for the CMS magnet went very well.

At the request of the Director General the order of the agenda was modified such as to start with the LHCC presentation.


M. Calvetti reported on the 60th meeting of the LHCC. He first described the findings of the CMS and ATLAS Installation Reviews [2,3] which were chaired by R. Cashmore. CMS has already started its installation as it is intended to assemble the detector on the surface before lowering it in sections. The ATLAS installation will be more complex as it involves the assembly of the large toroid in a tight space. Their toroid geometry results in magnetic fields in open spaces which will necessitate stringent control of any loose ferromagnetic material. For both experiments safety is an issue, in particular during the transport of heavy equipment in the caverns during detector commissioning. The installation of ALICE and LHCb will be reviewed in March. The LHCC recommends that installation of the experiments be reviewed periodically and that CERN coordinates a common approach to safety and materials as well as the overall scheduling of transport and, in particular, of crane drivers. The use of manpower from external institutes should be investigated.

Cashmore replied that a very detailed review has already taken place and that several parts of this recommendation are already being acted upon. A further half day review of the ATLAS
and CMS installation requirements will take place in March, after which these requirements will be reviewed annually. Schlatter added that the four experiments have listed their installation needs and their merging has already been worked out partially. May pointed out that until the installation requirements of the accelerator are included as well it will not be known whether all needs are covered.

In reply to Zalewska, May informed the Research Board that satisfying the seismic requirements is a legal obligation and that the most critical step is when the detector is only partially assembled.

The Research Board accepted the LHCC recommendation.

The chairman of the LHCC described the ATLAS and CMS presentations at the open meeting of the LHCC on their initial physics programme. At a luminosity of $2 \times 10^{32}$ cm$^{-2}$s$^{-1}$ the programme will include measuring reactions such as $Z^0$ to $e^+e^-$ to calibrate the calorimeters and $Z^0$ to $\mu^+\mu^-$ to define the momentum scale. In addition minimum bias events and QCD jets will be recorded to cross check simulation programs. Jets and single leptons at a variety of threshold will also be needed to measure trigger efficiencies. As an example he quoted numbers presented by ATLAS. A total of $10^9$ events are expected to be recorded in the first year which would result in storage requirements of 1.6 PB for the raw data, 1.0 PB for the reconstructed data and a total computing requirement of 178 kSI95. If in situ calibration is not available a 25% degradation in the sensitivity to H to $\gamma\gamma$ is expected. For ATLAS the staged trigger and detector items would result in a 10% loss in sensitivity in some light Higgs decay channels and in jeopardizing the B physics programme. No further staging of computing power is possible.

Calvetti presented the report [4] of the LHCC referees on the LHC Computing Grid (LCG) Project. The project is divided into a first phase covering the years 2002-2005 dedicated to preparing and deploying the environment for LHC computing and a second phase over the years 2006-2008 to build and operate the LHC computing service. The goals of Phase 1 are the development of applications, the development of software for managing a computing system of the appropriate scale, and putting in place a pilot system which will be a proof of concept and will be used for data challenges. The many existing regional computing centers will have to collaborate much more closely. It is planned to have a 50% framework (enough to cope with half of the requirements of one of the major LHC experiments) by December 2004 and an LHC Global Grid TDR by June 2005.

Phase 1 of the LCG has been approved by Council and LHCC referees have been appointed to provide the necessary information to the LHCC and to define and monitor milestones. The LHCC recommends to the Research Board to express its strong support to this project.
Hoffmann informed the Research Board that whereas manpower is not a problem there is currently a funding shortfall of 9 MCHF for Phase 1. Some small additional contributions are hoped for and discussions with the US on the possible funding of common projects are ongoing.

Blaising pointed out that in going from the prototype to the final phase it would be advantageous to involve computer companies. The Research Board was informed that several companies were interested.

The Research Board took note of the LHCC recommendation and urges the Computing RRB to consider it and to search for possible sources of extra funding.

Calvetti also presented the ALICE Addendum to the Time-of-Flight Technical Design Report [5] which was discussed in detail at the last Research Board [1]. The time-of-flight system covers the barrel region and is based on multi-gap glass RPC’s. Its intrinsic time resolution is less than 50 ps and this allows the separation of pions, kaons and protons in the momentum region relevant to heavy-ion collisions. It is complementary to the TRD which is designed to identify electrons at high momentum. The current version of the read out electronics is well adapted but uses too much power and is expensive. They are designing a dedicated ASIC which should be ready in time to achieve the projected milestones. The cost is fully covered by the INFN but only Bologna is involved in the realization of the project. The committee congratulated the ALICE Collaboration for the introduction of this new technology. The LHCC was satisfied that the proposed detector meets the requirements of the experiment and recommended general approval of the ALICE addendum to the Time-of-Flight Technical Design Report.

Hoffmann stressed that glass RPC’s represent a very interesting technology. However being a new technology progress must be monitored.

The Research Board approved the submitted addendum to the TDR under the LHCC formulation, which allows the Committee to monitor further progress of this project through the implementation of schedules and milestones listed in the ancillary document.

The chairman of the LHCC discussed briefly the CMS Comprehensive Review [6]. He informed the Research Board that the collaboration was well organized and that the installation was well planned. Two items need to be followed carefully: the electromagnetic calorimeter electronics and the tracker construction.

The Research Board took note.

Zalewska requested that Comprehensive Reviews be described in more detail, and it was decided that more time would be devoted to the CMS review at the next Research Board.
Roger Cashmore chaired the Research Board for the remainder of the meeting.


H. Flocard, took the opportunity of his last presentation to the Research Board as chairman of the INTC, to stress how much he had appreciated his interactions with the INTC community.

He then outlined briefly the achievements of n-TOF in 2002. The capture experiments collected $5.6 \times 10^{18}$ protons whereas $4.7 \times 10^{18}$ had been allocated. The excess was possible because the fission experiments were only able to use $1.2 \times 10^{18}$ protons instead of the $2.3 \times 10^{18}$ allocated. The nTOF collaboration is preparing the 2003 planning based on a September estimate of the number of available protons of $14 \times 10^{18}$. However the PS/SPS coordinator pointed out that, according to the latest estimate, only $12 \times 10^{18}$ protons are likely to be available. Claude Détraz stressed that n-TOF had now made the transition to a facility in full production of scientific results. A document describing the facility will be presented to the next meeting of the INTC and will be used to broaden the basis of users.

Flocard then presented two proposals: **P156**, Coulomb excitation of neutron-rich A~140 nuclei [7] and **P158**, Coulomb excitation of neutron-rich nuclei between the N=40 and N=50 shell gaps using REX-ISOLDE and the Ge Miniball array [8]. These proposals involve the use of radioactive beams at energies below the Coulomb barrier. They would study Coulomb excitation in a new region resulting in a better understanding of level densities. The committee recommended to the Research Board an allocation of 21 shifts of radioactive beams to **P156**, to be used with Cd isotopes beams which are only available at REX-ISOLDE. The INTC also recommended an allocation of 21 shifts of radioactive beams to **P158**, to be used first with 2.2 MeV/u Zn beams and then with 3.1 MeV/u Ni beams. The Research Board concurred with these two recommendations. P156 will be known as **IS411** and P158 as **IS412**.

The chairman of the INTC went on to summarize the operation of ISOLDE in 2002. This year saw the inception of the push-pull operation of the two target-separator ensembles, the GPS and HRS. This meant preparing one of the target-separators while the other one was taking data. This strategy was partly responsible for the large number of shifts delivered to physics, 375 up from 350 in 2001. However this puts the available manpower under severe constraints. 2002 also saw the construction of an ECRIS source.

The backlog of shifts has now been reduced from 800 in 1999 to 397, including 161 for REX-ISOLDE. No experiment older than 1998 is still pending with the exception of REX commissioning.
Claude Détraz noted that a backlog equivalent to about one and a half year’s operation is necessary to make the best possible use of the facility, in view of the wide variety of requested beams, and thanked Flocard for this achievement.

The Research Board noted with satisfaction the progress achieved in the last year and thanked J-P. Delahaye and his team.

Delahaye reminded the Research Board that REX-ISOLDE was built and currently is being operated by the collaboration but that the latter is now asking CERN to take over responsibility for the operation. However no resources are available for this. Détraz informed the Research Board that a proposal, prepared by the ISOLDE Collaboration, on how to manage the transition from an experiment to a facility will be discussed at the next INTC.

Flocard also presented the Report of the Audit Commission on the Solid State Physics (SSP) programme at ISOLDE [9] which had been requested by the Research Board at its June 2001 session [10]. The SSP community at ISOLDE prepared a presentation document [11] which was summarized by Flocard. The activities of this community are part of larger programmes carried out at home institutes and cover three areas: semiconductors, surfaces and interface, superconductors and magnetism. A total of 63 institutes from 16 countries participate in the 25 accepted experiments and the two letters of intent. Over the past five years the programme has resulted in 181 publications and 27 Ph.D. theses. He then presented the conclusions of the Audit Commission.

The installation provided a unique variety of beams and equipment. However the activities of the SSP community were crowded in a small area and a reasonably equipped laboratory is lacking. The complexity of the methods tend to make the nuclear SSP methods less attractive to the average user.

The scientific output is of high quality and compares favourably with the SSP world average but it does not have the impact it deserves. The user group is too stable and too closed.

The Audit Board was impressed by the many defect studies performed in all types of semiconductors and recommended that the community concentrate on systems which could result in a breakthrough. The surfaces and interfaces studies appear as the most promising ones for future exciting developments. Substitution Hg in high Tc materials was found to be a useful piece of work but not the state of the art. The Audit Board recommended switching to substitution on the oxygen site.
The following were some further suggestions of the Audit Commission:

   a) The INTC should pay attention that the teams are mixed, such as to include specialists in different techniques.

   b) A conventional physics laboratory should be added on site.

   c) The instruments should be made more open to the average user by providing technical support teams.

   d) Results should be more visible and should be published in journals such as Nature.

   e) The methods and potential should be advertised more aggressively at other institutes and at meetings.

The reaction of the ISOLDE SSP community was that the SSP programmes were regularly reviewed at the national level, that indeed results should be made better known but that it did not immediately see how the instruments could be made more generally available to the average user. The ISOLDE community stressed the fact that increasing the time allocated to the SSP programme could impact on the Nuclear Physics programme given the scarcity of resources. The INTC agreed with the conclusions of the report and stressed that all laboratories providing radioactive beams supported strong SSP programmes.

Calvetti pointed out that additional permanent staff would be needed to run the instruments if more users were to access them. In reply to Königsmann, Flocard explained that the number of shifts used in a year by an SSP experiment is smaller than the average number for ISOLDE since the proponents tend to perform a large amount of work at home institutes between exposures.

Détraz was satisfied with the review since the quality and uniqueness of the SSP programme were confirmed. The concerns expressed in the report have to be taken into account, namely the visibility of the programme, the “closed” nature of the community and the lack of space. He requested the INTC to monitor progress on these three topics.

The Research Board concurred and took note of the report.

4. REPORTS AND MATTERS ARISING FROM THE SPSC MEETING OF 5 NOVEMBER 2002

K. Königsmann summarized the discussions that took place at the 60th meeting of the SPSC. Status reports on NA48, NA48/1 and NA48/2 were presented. The final value for Re(ε'/ε) obtained by the experiment is (14.7 ± 2.2) x 10⁻⁴. Many other results have been published or are in preparation. NA48/1 had a very successful data taking period in 2002
and collected about 80% of the expected statistics. However it is not yet understood why fewer hyperon decays than anticipated were accumulated. Their measurement of BR (K⁰, to γγ) yields a value of (2.78 ± 0.06 stat ± 0.04 syst) x 10⁻⁶. This is much more accurate than previous measurements and is in disagreement with O(p⁴) calculations of Chiral Perturbation Theory. The NA48/2 experiment which intends to search for CP violation in the decay K⁺→3 π⁺ requires simultaneous K⁺ and K⁻ beams. The beam modifications are well under way. The incident particles will have their momentum measured by the KABES beam spectrometer, the readout for which is on a very tight schedule.

The Research Board took note of the good progress of these three experiments. It had been hoped that US groups would bring an existing TRD module for electron/pion discrimination. However these groups could not obtain the necessary funding for the required modifications and for the transport. It was however ascertained that a rejection against pions of 3600 could be obtained from the calorimeter alone by using neural network techniques while maintaining a good electron efficiency. The US groups have nonetheless joined the collaboration and the Research Board asked Détraz to ascertain that they contribute a fair share to the common fund of the experiment.

P324 Biological Effectiveness of Antiproton Annihilation [12] is a proposal to measure, at the AD, the relative biological effectiveness of antiprotons for cancer therapy. The costs of running this experiment would be entirely covered by Pbar Medical. The SPSC considers it an interesting measurement but still has several questions on organizational matters. An addendum will be submitted to the January SPSC. In the ensuing discussion, Rubio suggested that ETT division could help on technology transfer issues.

NA45/CERES has requested participation in the 2003 indium run. The committee has asked for more details on the physics impact of the these new measurements. An addendum will be submitted to the next SPSC. Their request for a low energy indium run was not accepted.

NA49 and NA57 have also requested beam time during the indium run but the committee considers an addendum to the proposal to be imperative. This will also be submitted to the January SPSC.

DIRAC has submitted an addendum to their proposal requesting 3 months of data taking in 2003 aimed at studying sources of systematic errors. In particular, nearby tracks in the scintillating fibres detector could introduce a significant systematic uncertainty. However many questions still remain on the magnitude of their current systematic errors, and how they compare to the statistical error (14%); a further addendum has therefore been requested.
Königsmann then summarized the 2002 run. **HARP** was able to complete its programme and a prolongation of its run was used to measure $\pi^+$ and $\pi^-$ production in an energy regime relevant to the LSND neutrino oscillation result. **DIRAC** suffered from septum problems resulting in a 15% loss of beam time in 2002. They performed systematic checks for 6 weeks. **NA49** collected very good data at 20 and 30 A GeV. Finally **NA60** tested their silicon beam detector and three pixel planes which, except for minor technical problems, performed according to specifications.

The SPSC expressed its deep appreciation of the reliable and efficient operation of the accelerators by the PS and SL divisions. The Research Board **concurred** with this appreciation.

Cashmore noted that before any experiment or extension is approved it would have to demonstrate what additional knowledge it would bring as well as have a thorough appraisal of the additional resources it would need.

Hauschild reminded the Research Board that notwithstanding the good results obtained, the East Hall did not function optimally due to a defective power supply. It was fortunate that this supply did not break down entirely as there is no spare for it due to lack of resources. It still limited the energy of the primary beam and the overall number of spills.

Détraz informed the Research Board that a significant breakthrough was achieved at CERN in the last few weeks. Both **ATHENA** and **ATRAP**, using different techniques, were able to observe large numbers of anti-hydrogen atoms. Several orders of magnitude improvements in the production rate of anti-hydrogen are feasible and this opens the way for anti-hydrogen spectroscopy. The Research Board **expressed its satisfaction**.

In reply to a question by Schlatter, Détraz said that a workshop on the future possibilities of anti-hydrogen measurements at the AD was planned.

### 5. ANY OTHER BUSINESS

M. Hauschild presented the accelerator schedules for 2003. For the PS complex, ISOLDE will run for 181 days to be compared to 192 in 2002. nTOF will be allocated $12 \times 10^{18}$ protons up from $7 \times 10^{18}$ this year. The AD will run for 98 days to be compared to 100 days in 2002 and the East Hall will run for 171 days unchanged from this year. In the East Hall, the T9 line, which had been used by HARP, will now be available as an additional test beam. The T8 beam, if no longer used by DIRAC, would provide a possible new location for LHC irradiation studies. About 72% of the available test beam time has been requested at this time.
The 2003 proton run at the SPS would start with an MD on beam scrubbing for LHC. The proton run will include one week of 25 ns LHC-type beam. This was requested to be early in the year but only after some normal proton running which would allow setting up of the LHC detectors to be tested. The decision was therefore to start with a few days of normal proton running to be followed by one week of 25 ns running and ending with 14 weeks of normal proton running. A 39-day Indium run will then follow terminating at the end of October. A total of 29 groups have requested SPS test beam time, 70% of which has been requested by LHC groups. Some beam lines are overbooked by as much as 30-40%. Two lines are fully allocated to ATLAS and CMS. In a third line, a CMS request of a permanent allocation of space would limit its use to other users while the beam conditions requested by ATLAS in H8 would affect the use of the fourth test beam.

The SPSC will have to rule on two potential problems for 2003. The first one is the request by NA60 for five weeks of proton running, which is in conflict with the NA48 request for the full 15 weeks available. The second one is the request by several experiments to participate in the Indium run.

The schedules presented by the PS/SPS coordinator were approved by the Research Board and are appended to these minutes.

A change in the procedure for publishing the Research Board minutes was agreed to. Following approval of the minutes by the Directors of Research and the Director General, the minutes would be sent to all members of the Research Board by electronic mail. Any corrections would have to be sent to the Secretary within two days. Any such correction would be made if approved by the Director General. The minutes, carrying the mention “Draft”, would then be posted on the Web and sent out by mail. Upon approval of the minutes at the following Research Board, the mention “Draft” would be removed from the Web version.
ENCLOSURES


REFERENCES

[7] Coulomb excitation of neutron-rich $A \sim 140$ nuclei (INTC 2002-015/P156).
[8] Coulomb excitation of neutron-rich nuclei between the $N=40$ and $N=50$ shell gaps using REX-ISOLDE and the Ge MINIBALL array (INTC 2002-017/P158).
[12] Relative biological effectiveness and peripheral damage of antiproton annihilation (SPSC 2002-030/P324).