MINUTES OF THE 163rd MEETING OF THE RESEARCH BOARD
HELD ON THURSDAY, 10 APRIL 2003


*part-time

Apologies: H. Hoffmann, C. Wyss

Items
1. Procedure
2. Reports and matters arising from the INTC meeting of 24 February 2003
3. Reports and matters arising from the SPSC meeting of 11 March 2003
4. Report on the LHC Installation Reviews (K. Potter)
5. Reports and matters arising from the LHCC meeting of 26-27 March 2003
6. Any other business
1. PROCEDURE

The minutes of the Research Board held on 6 February 2003 [1] were approved without modification. Under matters arising, C. Détraz reported on three items:

1. The NESTOR collaboration (recognized experiment RE9) has successfully deployed a “floor” of their detector, consisting of 12 photomultiplier tubes mounted on a titanium frame, at a depth of 4000 m in the Ionian Sea. L. Maiani commented that this was an important step towards the realization of the experiment, and the Research Board congratulated the collaboration on their achievement.

2. Progress is being made towards defining a Memorandum of Understanding for experiment AD-4, that will investigate the effect of antiprotons on living cells. A draft has been prepared by the collaboration and is now being discussed with ETT division.

3. The ICARUS experiment, as part of the CNGS programme, required joint approval by both CERN and INFN. An exchange of letters from E. Iarocci, President of INFN, and L. Maiani, Director General of CERN, has completed the procedure, so that ICARUS is now fully approved, with experiment number CNGS-2. C. Détraz brought one of the paragraphs from the Director General’s letter [2] to the attention of the Research Board, in which it is stated that the baseline plan approved by CERN Council confirms that CERN will produce the CNGS neutrino beam in spring 2006, but makes no provision for allocation of financial or manpower resources to ICARUS.

2. REPORTS AND MATTERS ARISING FROM THE INTC MEETING OF 24 FEBRUARY 2003

J. Äystö reported on the last meeting of the INTC. He discussed four experiments that were recommended for approval by the committee.

Proposal P113 Add. 2 Decay study for the very neutron-rich Sn nuclides, $^{135-140}$Sn, separated by selective laser ionization [3]. The experiment requested additional beam time for the investigation of very neutron-rich tin isotopes. It will study the $\beta$-decay of nuclides that lie directly in the path of $r$-process nucleosynthesis. Data will add fuel to the debate about a possible change of $r$-process mechanism near $Z = 56$. In response to a question from L. Maiani, J. Äystö explained that the typical lifetime of such neutron-rich isotopes is a few hundred milliseconds. K. Königsmann enquired whether the earlier results of the experiment have been presented, to which J. Äystö responded that they had, but that the collaboration wished to improve the data, particularly for $^{137}$Sn. The Research Board approved the experiment for a final allocation of 8 shifts; it will continue to be known as IS378.
Proposal **P166** Magnetic moments of Coulomb-excited $2^+_1$ states for radioactive beams of $^{132,134,136}$Te and $^{138}$Xe isotopes at REX-ISOLDE [4]. The proposed study will use the technique of projectile Coulomb excitation in inverse kinematics, in combination with a transient field in ferromagnetic gadolinium, employing REX-ISOLDE and the Miniball array. The measurement of magnetic moments and transition strengths near $N = 82$ would provide an important probe of collectivity versus single-particle motion. J. May enquired how many shifts had been approved already for REX-ISOLDE, and T. Nilsson replied that the total was about 150, with most of the outstanding shifts to be cleared this year: if approved, the experiment would be expected to run in 2004. The Research Board approved the experiment for 30 shifts; it will be known as **IS415**. There should be an intermediate status report to the INTC after 12 shifts.

Proposal **P167** Production of rare-earth isotope beams for radiotracer-DLTS on SiC [5]. The proposal envisages using the first accelerating part of REX-ISOLDE to implant energetic radioactive ions for photoluminescence and Deep Level Transient Spectroscopy in SiC. The electrical properties of semiconductors are extremely sensitive to minor traces of impurities and defects; in the proposal the electronic properties and doping effects of rare-earth elements will be investigated in the technologically-important semiconductor SiC. The INTC had recommended the proposal for approval for 8 shifts as an initial allocation, followed by a report to the committee before any further allocation of shifts would be discussed. In response to a question from W.-D. Schlatter, J. Äystö explained that the first set of shifts would be sufficient for a self-contained experiment, not only for a test. The Research Board approved the experiment for 8 shifts; it will be known as **IS416**.

Proposal **P169** Delayed particle study of neutron-rich lithium isotopes [6]. The proposal involves a detailed study of the $\beta$-delayed multiparticle decay of neutron-halo nuclei $^9$Li and $^{11}$Li, employing segmented, large solid-angle charged-particle and neutron detectors, including the TONNERRE neutron detector array. The interest of such measurements is to understand the influence of the neutron halo on the $\beta$-decay strength and the coupling of the halo to the core nucleus, as well as a search for the signature of two-neutron $\beta$ decay. Responding to a question from L. Maiani, J. Äystö commented that two neutrons alone cannot form a bound state, but this can occur in the proximity of the core nucleus, illustrating the importance of three-body effects in such nuclei. The Research Board approved the experiment for 30 shifts; it will be known as **IS417**.

J.-P. Delahaye enquired about the status of the positions that were being funded by the collaboration for the support of REX-ISOLDE. C. Détraz replied that this issue was related to the discussion of the eventual transformation of REX-ISOLDE from an experiment into a facility, which was ongoing, and should be clarified in the coming weeks.
3. REPORTS AND MATTERS ARISING FROM THE SPSC MEETING OF 11 MARCH 2003

K. Königsmann reported on the recent SPSC meeting. He started with a discussion of two items deferred from the previous Research Board meeting, the status of NA60 and COMPASS/NA58.

**NA60** is progressing well in its preparation for the study of prompt dimuon and charm production in the indium ion run that will take place later this year. Three pixel-detector planes of the type that are required for its vertex detector operated well in the heavy ion run last year, and good progress is being made towards the construction of the remaining pixel planes. K. Königsmann showed mass plots from the experiment’s analysis of pA data from last year, illustrating that a dimuon mass resolution of about 20 MeV/c² is achieved at the φ mass. A. Zalewska commented that this excellent mass resolution should allow the experiment to complement the previous measurements of NA45 in the region of the ρ.

The present status of **COMPASS** is that the initial setup is complete, and first physics results are in preparation concerning Λ, K⁰, φ and diffractive ρ production. In September 2002 the collaboration organized a workshop to discuss their possible future physics programme, beyond 2005. The topics discussed included studies of the nucleon spin structure, transversity and deeply-virtual Compton scattering, tests of chiral perturbation theory, and the search for exotics, glueballs and doubly-charmed baryons.

The Research Board took note of the status reports concerning NA60 and COMPASS. **NA50**, the predecessor of NA60, has asked to be considered an active experiment in 2003, and the Research Board agreed to their request.

K. Königsmann then discussed the status of **ATHENA/AD1** and **ATRAP/AD2**, that had been presented at the recent SPSC meeting. Their goal is the high-precision comparison of hydrogen and anti-hydrogen, allowing a test of CPT to be made at a level of better than 10⁻¹³ precision. Both experiments are now routinely producing large samples of cold anti-hydrogen. ATHENA typically captures and stores 10⁴ antiprotons and 10⁸ positrons in a 5 minute cycle, while ATRAP typically captures and stores 10⁵ antiprotons and 2 × 10⁶ positrons in a 60 minute cycle. The experiments differ in their approach to the detection of the anti-hydrogen, ATHENA detecting the back-to-back 511 keV photons from the positron annihilation and a three-or-more prong vertex from the antiproton annihilation, while ATRAP relies on a signal from ionization by field gradient. They also differ in their interpretation of the production mechanism, via a two- or three-body process, which they determine by studying the temperature dependence. Their next priority is to trap the produced anti-hydrogen, in preparation for studying its spectroscopy. The SPSC has requested written status reports from both experiments including a detailed programme until
the end of 2004. The Research Board **congratulated** the two experiments on their progress, and looks forward to receiving the reports on their future plans.

Finally K. Königsmann discussed the requests of CERES/NA45 and NA49 to participate in the indium run this year. At the previous Research Board meeting, the request from NA49 was not approved, due to concerns of interference with test beam for CMS. However, following that meeting it was understood that it was possible to rearrange the schedule to avoid such interference, so NA49 renewed their request. CERES had been asked to report to the SPSC on the physics impact of an indium run limited to 30 days, including a comparison to the data that was taken by the experiment in 2000 (with improved mass resolution). The effect of reducing the length of the run to 30 days was expected to be only a 12% increase in the statistical errors. However, a comparison with the data from 2000 could not be performed, as the analysis of that data is not yet complete, due to difficulties with the calibration of the TPC. Instead, a comparison was shown with a Monte Carlo simulation of the expected results from 2000. J.-J. Blaising expressed concern over the length of time that the analysis of the 2000 data is taking, which suggested a lack of available manpower. It was considered that the added value from the indium run for CERES compared to the predicted results from their 2000 data was not sufficient to justify changing the existing plan. K. Königsmann then showed some exciting recent results from NA49, concerning a clear peak in the K-to-π ratio at low SPS energies. R. Cashmore agreed that they were interesting results, which may well deserve to be investigated further with a full programme of new measurements. However, it was felt that the single measurement of the high-energy indium run would not add significantly to the lower energy results. The Research Board therefore **did not approve** the requests of CERES and NA49 to participate in the indium run. L. Maiani encouraged the experiments to complete their studies of the existing data, and after deep analysis of the results to bring forward any new ideas for a possible future programme of measurements beyond 2005.

### 4. REPORT ON THE LHC INSTALLATION REVIEWS

K. Potter presented a summary of the recent Installation Reviews of experiments at the LHC: ALICE [7], ATLAS [8], CMS [9] and LHCb [10]. These one- or two-day reviews are held annually, with a brief follow-up after six months: the reviews for ALICE and LHCb were the first that had been held for those experiments, whilst the reviews for ATLAS and CMS were following-up on those that took place last September. The idea of the reviews is to study the installation schedules and milestones of the experiments, to understand the resources that are required, to identify any potential risks for the installation and to assess critical-path items. In particular, issues of survey and alignment, as well as
safety, are addressed. The review committee is chaired by R. Cashmore, as Director for Collider Programmes, and includes representatives from the LHCC, the technical sector, EP and TIS divisions, as well as three external members.

**ALICE** is re-using the existing UX25 cavern and the L3 solenoid; they will install a new muon spectrometer including a dipole magnet. They plan to make some pre-installation tests on the surface, in particular for the space-frame that will support detectors inside the solenoid. Amongst the items that the committee recommends should be further addressed are the pre-assembly and testing of installation on the surface, the testing and commissioning of detectors in the magnetic fields, allowing more time for global commissioning of each sub-detector into the experiment, and possible interference from machine installation requirements. More work is needed in particular on detector services and cabling, and on the final commissioning, but there is every reason to believe that ALICE will have a useful, working detector ready for the first collisions in spring 2007.

**LHCb** is a single-arm spectrometer with a fixed-target like geometry (although studying pp collisions). The interaction point is displaced to one side of the hall, to allow sufficient space for installation of the experiment across the existing UX85 hall. The forward spectrometer layout provides good access to the sub-detectors for installation and maintenance. Amongst the items that the committee recommends should be further addressed are maintaining the good coordination with the machine installation (particularly concerning the cryogenics as there are cold boxes sited in UX85), the delicate assembly of the RICH-1 sub-detector, and the requirements of the machine sector test with beam (foreseen for April 2006). More work is needed in particular on detector services and cabling, and on the final commissioning, but there is every reason to believe that LHCb will have a complete and working detector ready for the first collisions.

The **ATLAS** installation will be difficult due to the size of their toroid, which leaves little free space in the underground hall. Due to lack of a suitable surface building many of the installation operations will be performed for the first time underground. Most of the concerns from the September review have been addressed, and the use of single-shift work in the schedule gives some contingency. They are now planning a full-current test of the barrel toroid, as recommended by the Magnet Advisory Group. An on-going effort is required to ensure that they will have a working detector ready for the first collisions.

The **CMS** detector has been engineered for ease of installation, access and maintenance, profiting from its (relatively) compact dimensions. It is assembled from sections that can be constructed on the surface and lowered to the experimental hall, which allows progress to be made despite the late date foreseen for the delivery of the hall to the experiment (in July 2004). Delays in arrival of certain sub-detectors may make it difficult to complete
installation and leave adequate time for global commissioning, but it is expected that CMS will have a working detector ready for the first collisions.

The technical coordination teams of all four experiments were judged to have the installation programmes well in hand, and as far as it was possible to determine the present resource arrangements are commensurate with their installation plans. K. Königsmann asked what was the status of the TOTEM experiment, and whether it would cause a delay for CMS. M. Calvetti replied that the collaboration was working closely with CMS and the accelerator groups, and there will be a report on the project at the end of the year; K. Potter added that the forward region is rather independent, so integrating TOTEM should not cause any delay for CMS. L. Maiani thanked K. Potter for his comprehensive summary of the installation reviews, and commented that the careful study of available resources has required an enormous effort, but has resulted in excellent progress. The Research Board took note of the reports.

5. REPORTS AND MATTERS ARISING FROM THE LHCC MEETING OF 26-27 MARCH 2003

M. Calvetti reported on other items from the recent LHCC meeting, starting with the report of the Magnet Advisory Group concerning the status of the experiments’ magnets.

The LHCb dipole magnet coils have been constructed and delivered to CERN, and the 1450-ton yoke is being made and will be delivered on demand. Installation work has started at Point 8, the power converter is being commissioned and costs are within estimates. The ALICE dipole magnet for their muon spectrometer takes advantage of the LHCb experience. The coil manufacture has started and the yoke has been machined; assembly tooling will be ready at CERN in April, and assembly is planned to take place by the end of 2003. The CMS solenoid assembly is well underway in the surface hall, the yoke and end-caps are complete and the cryogenic infrastructure is being installed. The production of conductor is no longer a concern, but delays for the mandrels have led to the coil being about four months behind schedule: the situation will be reappraised by the Advisory Group in June. The ATLAS system consists of four large superconducting magnets: the central solenoid, the barrel toroid and two end-cap toroids. The central solenoid coil, turret and chimney were delivered to CERN in 2001. Good progress was reported on the toroids, and the end-cap toroid schedule is no longer considered to be critical. For the barrel toroid the last coil will be delivered to CERN in April, but there is some delay for the thermal shields; when they become available the tests of the coils can proceed. The Advisory Group considers the schedule to be tight but feasible.
The Research Board took note of the remarkable results that have been achieved by the experiments in the preparation of their magnets, and of the positive statements from the Magnet Advisory Group.

M. Calvetti then discussed the Comprehensive Review of ALICE [11]. Since the previous Comprehensive Review in March 2002, ALICE has made very significant progress towards the realization of their experimental set-up to study pp and heavy-ion collisions at the LHC. Most of the detector technologies to be used, together with the associated electronics, have successfully gone through the R&D phase and several major sub-detectors are preparing to begin series production. The collaboration has adopted measures to control increases in the cost-to-completion, and the concerns from the previous review have been satisfactorily addressed.

Good progress was reported on all elements of the inner tracking system (the silicon pixel, silicon drift, and silicon strip detectors) and for the TPC, for which there are no major concerns. The particle-identification detectors are also progressing well, although various issues will continue to be monitored, in particular the front-end electronics for the time-of-flight detector. Good technical progress was noted for the calorimeters, but concern was expressed regarding the funding of the photon spectrometer (PHOS) and the tight schedule for its read-out electronics. An addendum to the photon multiplicity detector TDR is awaited, detailing the modifications to the detector and corresponding impact on the physics. For the dimuon forward spectrometer, good technical progress was also noted, but concern was expressed regarding the tight schedule to complete the muon absorber and the complexities associated with the production of the tracking chambers. The design of the forward detectors is advancing, but many details still need to be finalized and a common forward-detector TDR is expected by the end of 2003. Considerable progress has been reported for the trigger, the Higher-Level Trigger and the DAQ, but the limited common work between HLT and DAQ remains a concern; a joint Trigger/HLT/DAQ TDR is expected in December 2003. The software and computing projects are advancing well, and the committee is satisfied with progress on the physics issues; submission of a Physics Performance Report is expected this year.

The Research Board took note of the report on the ALICE Comprehensive Review, and encourages the collaboration to continue its good progress.
6. ANY OTHER BUSINESS

There were three items of other business:

1. M. Hauschild presented the accelerator schedules for approval [12]. There has been bad news from the PS, with two out of the 100 main bending magnets experiencing insulation faults, as indicated by unacceptably high leakage currents during high-voltage tests. Spares are being installed in their place, but with a resulting delay of three weeks in the PS startup, and two weeks for the SPS startup. The proposed schedule, accounting for these delays, was approved by the Research Board. The possibility of extending the run in November was mentioned by M. Hauschild, but will only be discussed at the next Research Board meeting after all the implications have been investigated. A PS consolidation working group has been formed to evaluate major renovation of the PS magnets during the long shutdown of 2005, when the PS will not be running.

2. R. Forty mentioned that all documents relating to the Research Board meetings are now available electronically, attached to the agenda that is accessible from the Web. For future meetings short documents will no longer be distributed as printed copies. However, paper copies of the minutes will continue to be distributed, as well as any long or difficult-to-print documents. The Research Board agreed to this proposal.

3. The next meeting will take place in the afternoon of 5 June. R. Cashmore mentioned that on the day before there will be a ceremony to mark the official inauguration of the ATLAS cavern, to which the board members will be invited.
ENCLOSURES

1. Letter to E. Iarocci concerning the approval of ICARUS
2. Minutes of the 15th INTC meeting held on 24 February 2003 (INTC 2003-013/INTC 15)
3. Minutes of the 62nd SPSC meeting held on 11 March 2003 (SPSC 2003-014/SPSC-062)
5. Accelerator schedule

REFERENCES

[2] Letter to E. Iarocci concerning the approval of ICARUS (enclosed)
[3] Decay study for the very neutron-rich Sn nuclides, $^{135-140}$Sn, separated by selective laser ionisation (INTC-2003-004/P113 Add. 2)
[12] Accelerator schedule (enclosed)