MINUTES of the 80th Meeting of the SPSC  
Held on Tuesday and Wednesday 6th and 7th Feb 2007

OPEN SESSION:

1. Status Report of AD2 ATRAP  
   G. Gabrielse
2. Status Report of AD3 ASACUSA  
   R. Hayano
3. Status Report of AD5 ALPHA  
   P. D. Bowe
4. COMPAS Future Programme  
   A. Magnon
5. NA49 Future Proposal  
   M. Gazdzicki
6. QED Tests and Axion Search by mean of Optical Techniques  
   P. Pugnat

CLOSED SESSION

Present:


Apologies: J-P. Delahaye, L. Kluberg, P. Kooijman, J. Ritman

1. MINUTES OF THE 79th MEETING OF THE SPSC, HELD ON  
   NOVEMBER 21st and 22nd, 2006

The Minutes were approved with minor comments.
REPORT FROM THE CHAIRMAN

The 178th meeting of the Research Board took place following SPSC78 (October 2006) and SPSC79 (November 2006).

The SPSC chair reported to the meeting the following:

- After an initially hesitant start-up, a profitable programme of fixed target data-taking ensued for the year 2006:
  - COMPASS completed its $\mu$-deuteron data sample with longitudinally polarised target,
  - The CNGS beam was established at CERN, and neutrino events from CERN were observed in OPERA at LNGS. There is concern that enough target mass (bricks with emulsions) in OPERA will be available promptly for useful physics measurements in 2007.
  - Only DIRAC in the E Hall was unable to take data, because of a magnet failure.
- After a comprehensive review of all the CERN fixed target, heavy ion, experiments
  - NA45, NA50 and NA57 were concluded most successfully,
  - NA49 and NA60 are completing final analyses, and
  - There is consensus that fixed target, heavy ion, experiments at CERN are exceptionally well placed to take forward a new generation of measurements aimed at elucidating quantum chromo dynamic phase equilibrium near the critical point.
- The annual review 2006 of the experiment CNGS2 (ICARUS) was completed. The experiment will now pioneer the operation, and demonstrate the so far impressive performance, of large volume cryogenic detectors underground.
- The annual review 2006 of the series of $K$-decay experiments NA48/1/2 was completed; a series of results exceeding original expectation is now being obtained which are having major impact on this continually fertile field of flavor physics.
- The annual review 2006 of the R&D programme P326 in preparation for a possible new generation of rare $K\rightarrow\pi\nu\nu$ decays was completed, in which impressive progress was reported. It is now considered both experimentally possible and theoretically important to attempt a measurement of the ratio $K_e = K_{\mu}/K_{\tau}$ in the P326 R&D programme in 2007.
- The final annual review 2006 of AD1 (ATHENA) was completed with a comprehensive report on the outcome of the experiment.
- The annual review 2006 of AD4 (ACE) was completed in which impressive progress was reported concerning quantification of final results.
- The proposal “Electromagnetic Processes in Strong Crystalline Fields” P327 will be brought to the Research Board at its next meeting for consideration following consideration, and subsequent favourable recommendation, by the SPSC at SPSC79.

The Research Board noted the above.

The Chairman welcomed three new Referees, appointed to the SPSC as of February 2007: B. Bloch, M. Erdmann and A. Ereditato.

The Chairman also welcomed P. Lipari, who participated to the session of the SPSC in his quality as LNGS Referee for the CNGS1 OPERA Experiment.
3. STATUS OF ACCELERATORS

S. Baird reported on the status of the Shutdown activities, the expected outcome of the ATC/ABOC meeting held on January 22\textsuperscript{nd} to January 25\textsuperscript{th}, and on the prospects for the re restart of the Accelerator Complex.

**Shutdown Activities**

As previously reported to the SPSC79, in November 2006, a section of the LINAC2 had been affected by serious vacuum leaks.

The proposed approach of implementing a secondary vacuum, in order to achieve sufficient quality stable vacuum in the sections affected by the vacuum leak, appears to have been successful. This avoids the need for opening the tanks affected in order to directly repair the vacuum leaks, a far more time consuming procedure.

Other maintenance and consolidation work for the Accelerator Complex, including the LINAC2, PSB, PS and SPS as previously reported is ongoing, and progressing according to expectations.

**ATC/ABOC Days 22-25 January 2007**

This was a review of the major issues and problems for the Accelerator Operation in 2006, and intended to form the basis for recommendations for further optimization of the consolidation process.

A wrap-up of the resulting conclusions and actions to be taken is planned for February 9\textsuperscript{th}. The following is a brief summary of the main issues and concerns.

Power Failure tests, carried out in response to the site-wide power cuts experienced this past summer, were largely successful. Most of the equipment concerned behaved as expected, while the remaining failures observed underscored the usefulness of realistic tests to fully shake down the system.

After the repair this past summer, the PS Main Power Supply (MPS) has operated normally. However, following the decision not to refurbish the damaged MPS Motor Generator, and to invest instead in a new power system scheduled to be in operation in 2010, there will be no spare rotors for the MPS Motor Generator during the next three years, from 2007 to 2009 included. In the event of failure, a full year would be required to refurbish the Motor Generator, and PS operation would have to rely on the use the available 13MVA transformer. This would allow for efficient LHC operation, but would significantly reduce the scope of the Fixed Target program.
The program of maintenance and consolidation, aimed at ensuring efficient operation of the LINAC2 until well after the new LINAC4 is commissioned, is being refined.

Studies of radiation levels in the PS, confirm the need for implementation of the Multi Turn Extraction scheme in order to ensure efficient beam extraction and tolerable radiation levels during high intensity CNGS operation.

Over the period from 2004 to 2006, the SPS control system has been brought up to state-of-the-art standards, and this will considerably improve operations, for example by allowing for changes in the Super Cycle to be rapidly and efficiently implemented.

There has been a substantial deterioration in the efficiency of the AD operation, directly attributable to the, resource driven, very low priority accorded to consolidation work for the AD.

Finally, the 2007 Accelerator Schedule, as approved by the Research Board of November 29\textsuperscript{th} 2006, was shown.

The SPSC notes with concern the implications of the lack of a spare Motor Generator rotor for the PS Main Power Supply, until 2010 when a new power scheme will render it obsolete.

The SPSC also underlines the importance of ensuring efficient operation of the AD facility, in the light of the approved research program.

4. STATUS OF EXPERIMENTAL AREAS

L. Gatignon reported on the status of the East, North, CNGS and AD Experimental Areas, and briefly outlined issues emerging from the ABOC/ATC days, relevant to the various Experimental Areas.

**EAST AREA**

The reasons for the repeated failures of the MNP23 magnets servicing the South Branch of the EAST AREA have still not been identified, in spite of an extensive programme of tests. Long-term tests in the T7 secondary area will continue.

The AB Department has now decided to replace the MNP23 magnet, by a simpler C-shaped MCB type magnet. The MCB magnet will powered with a bi-polar supply, in order to be able to ramp up or down in approximately one second, and thus allow for some form of switching between the North and South Branches of the EAST AREA within a Super- Cycle.
This solution should therefore allow for quasi-simultaneous operation of the North and South Branches, as was previously the case, although it will effectively result in a reduced efficiency by some 30% to 40% for irradiations in the T7 Branch.

Other routine modifications to specific experimental areas, as well as various maintenance activities are ongoing as expected.

NORTH AREA

Routine maintenance activities, as well as a considerable number of detailed modifications to accommodate the various requests for beam in 2007, are ongoing as expected.

These include re-establishing a proper beam dump behind COMPASS, in anticipation of a hadron run, and completion of the Control System upgrade to include items such as the CEDAR and XEMC.

CNGS

The source of the water leak, which forced the stop of the high-intensity commissioning run of CNGS last fall, has been well understood, and the affected parts will be replaced with an improved design.

However, in the course of the review process, it has become apparent that the underlying mechanism, which led to the leaks in the Reflector Drain Connections, may also affect the water inlet bellows in both the Reflector and the Horn.

In light of the difficulties, which any substantial intervention in this area would pose after significant high intensity operation, there is very strong recommendation to replace also these water inlet bellows as a preventive measure.

The SPSC notes the recommendation to carry out the preventive measures on the Reflector and Horn, and underlines the importance of ensuring the full planned operational lifetime of the CNGS facility.

The SPSC looks forward to clarification of the consequences of the proposed program of repair and preventive measures on CNGS operations for 2007.

AD

Routine maintenance work, and minor modifications are required, are ongoing as expected.
ABOC/ATC Days

The issues raised include: reconfiguring the EAST HALL layout to substantially reduce the number of different magnet types involved, thereby streamlining the maintenance requirements, as well as a major, six year program of replacement of the SPS NORTH AREA power converters, at a cost of some 23MCHF.

5. PS AND SPS SCHEDULES

C. Rembser reported on the requests for beam in 2007, and presented a detailed analysis of how these could be accommodated within the approved Accelerator Schedule for 2007, based on the new longer SPS Super Cycle, designed to optimize delivery of proton to CNGS and the Fixed Target program.

Projections for the years beyond 2007 were also presented, based on the same set of assumptions and taking in into account the expected requirements for LHC operations.

OPERA has requested a short run at the beginning of 2007 operations, followed by a high intensity pilot run, integrating $10^{19}$ protons on target at the end of the 2007 operations. Based on their projection of installing some 110’000 of the 170’000 emulsion bricks currently funded (compared to the original scope of 210’000), this high intensity pilot run would yield approximately 500 neutrino interactions, and allow the reconstruction of some 10 charm decay vertices.

However, until a definitive schedule for the preventive measures aimed at improving the robustness of the CNGS Horn and Reflector water circuits is made available, the prospects for such a high intensity run remain uncertain.

In the event of a sharply curtailed high intensity CNGS operation in 2007, the COMPASS experiment could receive sufficient protons on target to substantially complete their muon beam running, both with the transversely polarised NH$_3$ target and with the longitudinally polarised liquid Hydrogen target.

In the period from 2008 onwards, OPERA may receive as much as $4.1\times10^{19}$ to $4.4\times10^{19}$ protons on target a year, compared to a nominal $4.5\times10^{19}$, while COMPASS could integrate about $9\times10^{19}$ protons on target in the years 2008 to 2009. These numbers are upper limits, to the extent that they do not include the effect of heavy ions operations, be it for the LHC or for any Fixed Target program.

Other large requests for beam time in 2007 include 120 days by P326 to carry out both the proposed precision measurement of the ratio $R_K$, as well as tests planned as part of the detector development for the $K^- \rightarrow \pi^+\nu$ experiment; 30 days proton running from the NA49-future proponents; a total of 7 weeks in the H8 beam line for the RD22 Crystal
Reflection and Channelling program; 4 weeks for CALICE and 2 weeks for DREAM in the H6 and H4 beam lines respectively.

The P326 and RD22 requests present a potential conflict, to the extent that primary protons cannot be simultaneously delivered to the two beam lines, so that the setting of priorities is required in for optimizing the detailed schedule.

6. DISCUSSION OF THE OPEN SESSION

6.1 ATRAP

The SPSC congratulates ATRAP for their successful commissioning of the new apparatus, and the successful test of anti-proton stability in the combined magnetic and Penning trap.

The SPSC notes the ambitious plans for 2007, and the need for substantial beam time in order to realise it.

6.2 ASACUSA

The SPSC congratulates ASACUSA on its excellent quality laser spectroscopy results with anti-protonic Helium, based on their data collected in 2004, and on the resulting new publication of the world-best $m_{\text{p}}/m_e$ ratio, with a precision comparable to that of the available measurement of the $m_{\text{p}}/m_e$ ratio, as recently as a few years ago.

A remarkably improved resolution was demonstrated with the 2006 anti-protonic Helium spectroscopy data set, based on the use of a two-photon technique to decrease the Doppler width by almost a factor of 20.

The SPSC looks forward to the resulting improved $m_{\text{p}}/m_e$ measurement planned as part of the 2007 run, which is expected to closely match the precision of the current determination of the $m_{\text{p}}/m_e$ ratio.

The SPSC notes the progress achieved in 2006 towards the planned measurement of the spin magnetic moment of the anti-proton, as well as progress in the development of the Paul trap, as part of the program to establish anti-hydrogen ground state spectroscopy.

6.3 ALPHA

The SPSC congratulates ALPHA for their successful commissioning of the new apparatus and, in particular, on the successful operation of the novel octupole magnetic trap for neutral atoms and the resulting publication.

The SPSC notes the plans to include the silicon detector in the 2007 running period.
6.4 COMMENTS AND RECOMMENDATIONS FOR THE AD PROGRAM

Overall, the ongoing AD experiments continue to make good progress on their approved program and stated milestones.

In the light of this, the SPSC fully supports the request for beam time in 2007.

Availability of beam is clearly a limiting factor in the rate at which progress can be achieved by these AD experiments.

The SPSC underlines the usefulness of effective coordination among the AD experiments to optimize the efficient use of beam, expresses its appreciation of the efforts of the Coordinators and the Accelerator departments in maximizing the availability of beam, and stresses the importance of ensuring the level of AD consolidation and support required in order to ensure efficient operation of the AD facility and its experiments.

6.5 COMPASS FUTURE PROGRAM

The SPSC supports the proposed transverse polarised muon run, and longitudinal muon running on a proton target, which will complete the approved COMPASS muon program.

With regards to the proposed hadron program, the SPSC notes the difficulty of the physics questions raised, several of which are still unresolved despite a long history of previous measurements.

In the light of this, the SPSC wishes to better understand the potential for COMPASS to conclusively address these physics issues.

6.5 NA49 - FUTURE

The SPSC recognizes the compelling case and the importance of timely completion of the measurements proposed to support the T2K and cosmic ray experiments.

The SPSC also recognizes the fundamental interest of the questions addressed in the heavy ion program, which form the natural next step for the successful CERN Fixed Target heavy ion program.
The SPSC recommends approval of the 2007 pilot run, subject to existing constraints in the beam area.

The SPSC looks forward to a quantitative assessment of the impact of these measurements on the T2K physics program, and considers that analysis and timely production of the results for the p-C run would also demonstrate much of the functionality required to carry out the analysis of heavy ion data.

The SPSC encourages the NA49-Future collaboration to further study strategies for fully exploiting the capabilities of the upgraded detector and, in particular of the particle identification and improved centrality determination.

The SPSC also looks forward to a detailed analysis of the resources required, in order to move ahead with a timely recommendation on the proposed 2008 run and subsequent heavy ion program.

6.6 P-331 Proposal for QED tests and search for Axions by optical techniques (CERN-SPSC-2006-035/P-331)

The SPSC appreciates the elegance of the proposed methods, as well as the interest of the physics addressed.

The SPSC will seek clarification on a number of issues, as it moves to consider this proposal further.

7. FOLLOW UP ON EXPERIMENTS AND PROPOSALS

7.1 CNGS1-OPERA

OPERA continues to make good progress towards completing and commissioning their apparatus. Data from the 2006 low and high intensity runs is being used also in order to exercise the full analysis chain and procedures.

Brick assembly and installation, which have yet to go into sustained production, remains the critical path for OPERA’s readiness for physics.

Since last November, OPERA has made considerable progress both in improving the reliability of the operation of the Brick Assembly Machines (BAM’s), and in refining Brick assembly tolerances in order to ease production, while still meeting all performance requirements.
In particular, OPERA now relies on recording the positions of the layers of emulsion within a Brick for alignment information, rather than requiring an intrinsic mechanical placement accuracy of better than 50um, as had originally been the case. This has allowed relaxing substantially the requirement for mechanical placement accuracy, thereby removing one of the major problems encountered in commissioning the brick assembly procedures.

The material required to assemble bricks is loaded in “drums” of 230 bricks each. By early February, a production rate of 1 drum/day, or 230 bricks/day, with a single shift was sustained over a period of three days, until failure of a high intensity laser bar code scribe forced a temporary stop.

The OPERA collaboration now expects to ramp from an initial production rate of 1 to 3 drums/day, or 700 bricks/day, with a two-shift operation, by the end of March.

The target assembly rate of 700 bricks/day is well matched to the rate of brick component production, and in particular of the lead sheets. This rate is also matched to the capability of the Brick Manipulation System (BMS) to insert the bricks into the target, assuming once again a two-shift operation.

**The SPSC looks forward** to OPERA achieving and sustaining these target brick assembly and installation rates.

These assumptions result in a projected number of installed bricks of about 40’000 by the end of May, and of about 110’000 by mid-November, the beginning and end of the 2007 SPS operation respectively. The full currently funded 170’000 bricks would then be installed prior to the beginning of SPS operations in 2008.

Based on this, OPERA has requested an initial two week run in the Spring of 2007, to continuing commission of the detector and analysis chain, followed by a more substantial run integrating some $10^{19}$ protons on target as late as possible in the Fall of 2007, with the goal of registering 500 neutrino interactions and reconstructing about 20 charm decay vertices in the emulsion target, for a more in depth validation of the experiment.

**The SPSC appreciates** the usefulness of, **and supports the request** for a high statistics pilot run in 2007, **provided sufficient bricks can be installed** in order to achieve the stated goals, **and consistent with** carrying out the full program of repairs and preventive measures required to improve the robustness of the CNGS Horn and Reflector.

7.2 P326

A detailed analysis of the resources required for the proposed 2007 120 day run of P326 has been developed in close cooperation with CERN accelerator and IT departments, and the results of this have presented and discussed with the SPSC referees.
There has been a concerted effort, in particular to optimize the use of computing resources, by the implementation of an off-line L3 filter running on fully reconstructed events, which reduces the data storage volume requirements and corresponding costs by a factor of three.

In the light of this, and of its previous assessment of the importance of this run for addressing crucial questions for the $K^+ \pi^- \nu\nu$ experiment, as well as of the relevance of the measurement of the ratio $R_K = \frac{K\pi^2}{K\mu^2}$, the **SPSC strongly recommends approval** of the full P326 2007 run as proposed.

7.3 **HARP**

The status of the ongoing review of the HARP analysis, initiated by CERN and with the participation of representatives of the major Funding Agencies involved, was discussed.

The **SPSC looks forward** to a full report for its next meeting in April.

8. OTHER REQUESTS FOR BEAM IN 2007

**The SPSC supports** the 2007 beam requests for CALICE and DREAM.

**The SPSC also supports** the 2007 beam request for RD22, to the extent that it does not significantly detract from the P326 run.

9. A.O.B

With this session of the SPSC Serge Kox, Marcello Piccolo and James Ritman have completed their terms on the Committee.

On behalf of both the SPSC and the CERN Management, **the Chairman wishes to thank** the outgoing referees for their excellent service throughout their tenure on the SPSC.

Finally, visits to the experimental areas by the SPSC will be planned to coincide with the forthcoming meetings of the SPSC.
10. DOCUMENTS RECEIVED

Minutes of the 79th Meeting held on 21-22 November 2006 - SPSC-079; CERN-SPSC-2006-041.


Proposal for 2007 SPS beam time for the CALICE calorimeter prototypes; CERN-SPSC-2007-007/P-332.


The DREAM Project - Results and Plans Request for SPS Beam Time; CERN-SPSC-2007-008/P-333.