CERN RESEARCH BOARD

MINUTES OF THE 201ST MEETING OF THE RESEARCH BOARD
HELD ON MONDAY 24 SEPTEMBER 2012

Present

I. Antoniadis, S. Baird (replacing R. Saban), P. Bloch, F. Bordry, H. Breuker,
P. Butler, P. Collier, E. Elsen, R. Forty (Secretary), F. Hemmer,
R. Heuer (Chair), M. Kowalska, E. Meschi (replacing B. Gorini), J. Panman,
T. Pettersson, E. Tsesmelis, C. Vallee

Apologies

S. Bertolucci, B. Gorini, S. Myers, R. Saban

Items

1. Procedure
2. Report from the LHCC meeting of 13-14 June 2012
3. Report from the SPSC meeting of 26-27 June 2012
4. Any other business
1 PROCEDURE

1.1 The minutes of the last meeting [1] were approved without modification. There were no matters arising from the minutes.

2. REPORT FROM THE LHCC MEETING OF 13-14 JUNE 2012

2.1 E. Elsen reported on the latest meeting of the LHCC [2]. He pointed out that the meeting had been held 20 days before the announcement from ATLAS and CMS of the observation of a Higgs-like particle. The LHC machine performance had been excellent, catching up to the predicted integrated luminosity despite a difficult start. A peak luminosity of $7 \times 10^{33} \text{ cm}^{-2}\text{s}^{-1}$ had been achieved. E. Elsen noted that maintaining this performance required constant vigilance from those responsible for the machine.

2.2 The plans for upgrades of the LHC experiments were discussed along with their status, and selected physics highlights. R. Heuer requested that an overview table of the upgrade plans of the experiments and the associated documents should be prepared for the next Research Board. \textbf{It was agreed that the traditional procedure should be followed for upgrade TDRs of the LHC experiments, of recommendation by the LHCC followed by decision on approval at the Research Board.}

2.3 \textbf{ALICE} have been affected by high backgrounds, due to problems with the vacuum quality close to their interaction point. This has limited their participation in the \textit{p-p} running. P. Collier stated that there has since been some improvement from adjusting the filling procedure. Nevertheless they have had a rich physics harvest from \textit{p-p} and Pb-Pb running, including studies of the \textit{p/π} ratio in jets and the bulk, and elliptic flow at high $p_T$ and for $D$ mesons. They have submitted a conceptual design report for the ITS upgrade, and are planning to upgrade the TPC readout for higher rate: further deliberation is expected at the next LHCC.

2.4 \textbf{LHCb} has been running efficiently, using deferred triggering to profit from the inter-fill gaps for their high-level trigger processing. They have observed an interesting non-zero isospin asymmetry (i.e. difference between charged and neutral modes) in $B \rightarrow K \mu^+\mu^-$ decays, while the value for $B \rightarrow K^* \mu^+\mu^-$ decays agrees with expectation,
and they have started to compete in the search for lepton flavor violating decays through the search for $\tau \to \mu \mu \mu$. Concerning their upgrade plans a Letter of Intent was fully endorsed last year, and a Framework TDR has been submitted in June providing details on the schedule, cost, and interests of the collaborating institutes. A recommendation expected at the next LHCC.

2.5 **ATLAS** have made improvements to their trigger to help suppress pile-up, which might otherwise compromise the high luminosity running. Their observation of jet quenching in heavy ion collisions has been confirmed with higher statistics. They have measured tau polarization in $W$ decays, and see evidence for single-top production. Concerning upgrades, the IBL (inner B-layer pixel detector) has already been endorsed by the LHCC, and a Letter of Intent has been submitted for other elements of the ATLAS Phase I upgrade.

2.6 **CMS** have also continued the deployment of pile-up mitigating techniques, so that its effects are under control. Progress has been made in understanding the ECAL response, improving the resolution for $H \to \gamma \gamma$. Their limits on Supersymmetry have put the minimal models under pressure, although more complex models have not been ruled out yet. They see clear evidence of $\Upsilon$ excited-state suppression in the heavy ion data. CMS plan to submit TDRs for their pixel and HCAL upgrades.

2.7 **TOTEM** have published their measurement of the forward charged-particle pseudorapidity density, and have determined the total cross-section at the LHC. They request special runs at large $\beta^*$ during 2012. In the future they have an interest in $\beta^*$ values of 1000 m or greater, and F. Bordry commented that the work necessary for this is not yet part of the planning for LS1. R. Heuer proposed that there should be a statement from the LHCC concerning the physics motivation for such runs.

2.8 **LHCf** have measured $\pi^0$ spectra a very forward rapidity, and compared the $\gamma$ spectra at 0.9 and 7 TeV. They are preparing radiation hard detectors for the $p$-Pb run, and are investigating common read-out with ATLAS.

2.9 The work of the R&D collaborations RD39, RD42, RD50, and RD51 was reviewed. **RD39** studies radiation hard cryogenic silicon detectors. The LHCC considers that their emphasis should be focused on Beam Loss Monitors for accelerator applications, and that the R&D on charge-injected detector (CID) devices should be progressively
integrated into RD50 on the timescale of the next year. A status report is expected in one year’s time. **RD42** on CVD diamond tracking, **RD50** on radiation hard sensors, and **RD51** on Micro-Pattern Gas Detectors are all making good progress and are recommended for continuation. **The Research Board endorsed these recommendations.**

2.10 Concerning the other R&D collaborations, RD52 and UA9 are reviewed by the SPSC. **RD18** (Crystal Clear) that performs R&D on scintillation materials for novel ionizing radiation detectors for High Energy Physics, medical imaging and industrial applications, is not currently reviewed by a scientific committee, and it was agreed that the progress of RD18 will from now on be monitored by the LHCC.

3. **REPORT FROM THE SPSC MEETING OF 26-27 JUNE 2012**

3.1 C. Vallee reported on the latest meeting of the SPSC [2], including annual reviews of COMPASS, OPERA and ICARUS, a discussion of proposed short- and long-baseline neutrino experiments, and a possible measurement of the antiproton magnetic moment at the AD. **The Research Board took note.**

3.2 The SPSC congratulates the **COMPASS** collaboration for timely publication of new results on several aspects of the nucleon spin structure. Progress has been made in the analysis of the hadron beam data and the committee looks forward to publications in this area. The Primakov data taking has started successfully, and progress is being made on the experimental set-up for the DVCS run. The committee looks forward to results from the 2011 and 2012 data-taking periods.

3.3 Following successful collaboration between CERN, LNGS, OPERA, ICARUS, LVD and Borexino, the neutrino time-of-flight measurement has been brought to a conclusion, with updated measurements now consistent with the speed of light. The SPSC looks forward to the publication of the final results, and congratulates **OPERA** on the announcement of a second tau neutrino candidate event. The committee looks forward to completion of their analysis of the 2010 and 2011 data, and to the publication of the results.
3.4 The smooth operation and efficient data collection by **ICARUS** is appreciated by the committee, along with their contribution to the neutrino time-of-flight measurements. Progress in automated event filtering and reconstruction is acknowledged, and the SPSC is looking forward to first physics results.

3.5 Concerning the proposed short-baseline neutrino experiment **ICARUS+NESSIE**, first feedback has been received from the collaboration, addressing the questions from the committee on technical and organizational issues of the experiment. The SPSC will continue to review the proposal, including remaining open questions. A joint effort is recommended between the collaboration and the CERN accelerator departments to carry out the studies necessary to define the experimental set-up and to assess the costs and possible schedule for a new neutrino beam line and the experimental infrastructure.

3.6 An Expression of Interest has been received for a very-long-baseline neutrino oscillation experiment, **LBNO** [3]. This would involve a new beam from CERN to a large-scale liquid argon detector that would be sited in the Pyhäsalmi mine in Finland. The committee will further review the project.

3.7 A Letter of Intent has been received to perform a measurement of the **antiproton magnetic moment** with a $10^{-9}$ precision in a two-staged approach [4]. The magnetic moment is one of the least well known parameters of the antiproton, and would be measured for single trapped antiprotons from the ratio of their cyclotron and spin-precession (Larmor) frequencies. The SPSC recognizes the physics motivation and the opportunity offered at the AD, and invites the collaboration to submit a technical proposal. In view of the stringent stability requirements of the experiment, the committee advises that the insertion of the set-up at the AD is optimized in close collaboration with the accelerator and experimental area experts, and the other AD experiments.

3.8 Concerning the impact of the Long Shutdown 1 (LS1) on the CERN fixed target program, a memo had been received from the Accelerator Department heads [5]. The effect of any delay of the start-up after the shutdown will be discussed at the next SPSC, and will be returned to at a future Research Board. At the present meeting the implications for extension of this year’s run were considered. **It was agreed that the**
run for ISOLDE, AD, the East Hall and nTOF will be extended by two weeks, to 17 December.

3.9 **OPERA** also requested extension of their run beyond 3 December. A possible extension for two weeks in 2012 was considered not to give a significant increase in sensitivity of the experiment, compared to the statistics expected from the entire 2008-12 period, while it would entail a non-negligible cost. Extending the run further (at the start of 2013) to enable a significant impact to be achieved, would lead to radiation protection issues for the PS/SPS. This would delay the shutdown work on those machines, due to the need for a cool-down period after such running (the lower-energy beams used for the \(p\)-Pb run that is scheduled then will not have this effect). The work program for the PS/SPS already fills the available shutdown time, so such a run extension would in turn delay the restart after the long shutdown, and would thus have major ramifications for the program of all other experiments at CERN. **The extension of CNGS operation beyond 3 December was therefore not approved.**

4. **ANY OTHER BUSINESS**

4.1 The next meeting of the Research Board will be held at 9:00 on Wednesday 28 November. The dates of meetings in 2013 were confirmed: 6 March, 5 June, 4 September, and 27 November.

**ENCLOSURES**

1. Minutes of the 110\(^{th}\) LHCC meeting held on 13-14 June 2012 (LHCC-2012-008/LHCC-110).

2. Minutes of the 106\(^{th}\) SPSC meeting held on 26-27 June 2012 (SPSC-2012-024/SPSC-106).

REFERENCES


[2] Presentations are attached to the agenda page: https://indico.cern.ch/conferenceDisplay.py?confId=206089


OPEN SESSION I - Status Reports

1. LHC Machine Status Report: Steve Myers
2. ALICE Status Report: Andreas Morsch
3. LHCb Status Report: Diego Martinez Santos
4. ATLAS Status Report: Klaus Moenig
5. CMS Status Report: Yves Sirois
6. TOTEM Status Report: Jan Kasper
7. LHCf Status Report: Oscar Adriani
8. RD39 Status Report: Jasu Haerkoenen
9. RD42 Status Report: William Trischuk
10. RD50 Status Report: Gianluigi Casse, Michael Moll
11. RD51 Status Report: Maksym Titov

CLOSED SESSION:

* part-time

Apologies: U. Bassler, H. Breuker, W. Kuehn

1. PROCEDURE
The minutes of the one-hundredth-and-ninth LHCC meeting (LHCC 2012-006 / LHCC 109) were approved.

2. REPORT FROM THE DIRECTOR FOR RESEARCH AND SCIENTIFIC COMPUTING
The Director for Research and Scientific Computing reported on issues related to the LHC. He reported on the excellent performance of the LHC machine, experiments and computing. The aims for 2012 are to collect an integrated luminosity of 15 fb$^{-1}$ for each of the experiments ATLAS and CMS, an integrated luminosity of 1.5 fb$^{-1}$ for LHCb, special runs for TOTEM, a proton-Pb run to follow the proton-proton period and
machine studies. He referred to the possible extension of the 2012 LHC running period by one to two months, a scenario which is under consideration presently. He also reported on the positive response of the Resource Review Boards (RRBs) to the LHC experiment upgrade plans. A further discussion is planned for the upcoming RRBs in October 2012.

3. REPORT FROM THE LHC PROGRAMME CO-ORDINATORS

The LHCC heard a report from the LHC Programme Co-ordinators. They reported on the progress since the previous LHCC session, concentrating on the status of the 2012 physics run and on the overview of the schedule for the next three months.

The aim of an integrated luminosity of 15 fb$^{-1}$ for each of the experiments ATLAS and CMS and 1.5 fb$^{-1}$ for LHCb is within reach given the excellent performance of the LHC machine. A first review will be made in late June 2012 for discussing the possibility of extending the current physics run into the start of 2013, driven by the ATLAS and CMS Higgs search programme. The precision on the absolute luminosity is between 1.6% and 2.2% for ATLAS and CMS and the ATLAS and CMS integrated luminosities are now consistent to within 1%. Owing to individual bunch losses observed following the reversal of the LHCb spectrometer magnet polarity, a new machine filling scheme was introduced to remove most of the bunches that collide in interaction point IP8 only. The Co-ordinators also reported on requests for special runs. The special runs include measurement of diffractive physics at $\beta^*=90$ m (mainly TOTEM); measurements with the highest available $\beta^*$ values to approach the Coulomb interference region for elastic scattering; TOTEM studies to run-in the Roman Pots with a low-$\beta^*$ and high-intensity beam; and precision van der Meer luminosity scans. Special runs are also required to prepare the LHC beams with 25 ns bunch-spacing. The requirements for high integrated luminosities are making the scheduling of special runs particularly challenging. The detailed schedule for the heavy-ion run – proton-Pb and special proton-proton runs at a lower energy than the nominal - will be presented at the September 2012 LHCC session.

4. DISCUSSION WITH ALICE

Status of the ALICE Experiment

The LHCC congratulates the ALICE Collaboration on their activities in producing a rich set of physics results with many important analyses presented in the spring conferences. Since the last LHCC review, seven manuscripts have been submitted for publication with new QCD results in proton-proton and Pb-Pb collisions and 19 new preliminary results have been presented at the Hard Probes 2012 conference. New data from the Pb-Pb operation include energy loss of high-\textit{p}_T D mesons, the observation of a non-null $J/\psi$ elliptic flow, and suppression factors of reconstructed track-jets. These measurements, among others, provide valuable insights on the (thermo)dynamical properties of the dense partonic medium formed in nucleus-nucleus collisions at LHC energies.

The current proton-proton run at 8 TeV is being carried out with satellite bunch - main bunch collisions with a luminosity of $1.4 \times 10^{35}$ cm$^{-2}$s$^{-1}$. However, as observed last year during the proton-proton run, ALICE is experiencing severe background problems due to the vacuum conditions around the interaction point IP2 which prevent ALICE from switching on the detectors and collecting any data during the first 5-6 hours of each fill. The background problems are a factor of 3-4 larger on the C-side than on the A-side from the interaction point and have been identified as due to (i) high pressure in the TDI absorbers at 80m on the A-side due to out-gassing and/or impedance heating which leads to a 10 times larger than the tolerable ($8 \times 10^{-9}$ mbar) vacuum limit; and (ii) increased pressure due to electron clouds that build up in the 800 cm Zero Degree Calorimeter (ZDC) vacuum chambers at a distance of about 100 m on both sides of IP2. As a consequence, ALICE has only been able to collect a meager fraction of the planned integrated luminosity for the ongoing 8-TeV centre-of-mass energy run: 130M minimum
bias events and 40 nb\(^{-1}\) and 80 nb\(^{-1}\) in the barrel and muon detectors, respectively. Although no viable solution exists now under the current high-luminosity LHC running, it is crucial for the development of the future ALICE proton-proton programme that the vacuum situation be corrected during the coming Long Shutdown 1 (LS1) via: (i) insertion of NEG-coated layers in the ZDC chambers; and (ii) replacement of the TDI by standard collimators (and by a new TDI in 2015) and/or, at a minimum, an increase of the pumping power in the area.

The LHCC was informed of the improved status of various detector systems. The number of Time Projection Chamber (TPC) trips has decreased significantly (to one every few hours) after removal of the high voltage capacitors. The percentage of working Silicon Pixel Detector (SPD) half-staves is 93% after the unclogging of the cooling system. Finally, dedicated studies of the muon spectrometer alignment with 2011 data have resulted in an improved \(Y\) mass resolution from 151 MeV to 112 MeV, approaching the nominal 100 MeV value.

**ALICE Upgrade Plans**

The Committee discussed in detail the upgrade plans of the ALICE Collaboration for Phase-II (after the Long Shutdown 2 - LS2) proposed in the original documents submitted to the LHCC in early 2012: (i) “Upgrade Strategy for ALICE at High Rate”, (CERN-LHCC-2012-04), and (ii): “Conceptual Design Report for the Upgrade of the ALICE ITS”, (CERN-LHCC-2012-05).

The upgrade plans aim at a new Inner Tracking System (ITS) with improved capabilities in secondary vertexing, low-\(p_T\) tracking, momentum resolution and readout rate; a new TPC with Multi-Wire Proportional Chambers (MPWCs) replaced by Gas Electron Multipliers (GEMs); and a faster electronics readout for the central detectors (TPC, Transition Radiation Detector (TRD), Time-of-Flight (TOF) detector, and Electromagnetic Calorimeter (EMCal), Dijet Calorimeter (DCal), and Photon Spectrometer (PHOS) accompanied with a new DAQ (with pipelined readout) and High-Level Trigger (HLT) (event selection with online tracking/calibration) systems. The ultimate goal is to have a detector capable of inspecting 50 kHz of Pb-Pb and 2 MHz of proton-proton collisions, and to collect enough integrated luminosity (up to 10 nb\(^{-1}\) in Pb-Pb) for multi-differential studies around four major physics topics: (i) heavy-flavour and quarkonia, (ii) low mass di-leptons, (iii) jet studies with light-hadron identification; and (iv) heavy (mostly strange) nuclear states.

The physics case for the upgrade was the subject of detailed discussions during the LHCC session and pre-meetings. The proposed detector options were also scrutinized in dedicated meetings with the LHCC upgrade referees. The ALICE Collaboration presented updated studies based on a few physics benchmark processes which addressed the March 2012 LHCC recommendations:

a) Justify the need of 10 nb\(^{-1}\) integrated luminosity

The justifications of the high-rate needs are appropriate for measurements in the heavy open-flavour, charmonia and heavy-nuclear state sectors but needed to be worked out for low-mass di-electrons (for which the statistics is in principle very large) and for jets (with low rates but with the possibility of triggering).

b) Quantify (in terms of S/B, S/\(\sqrt{B}\), ...) the impact of the upgraded detector performance on the proposed measurement.

The need for the upgraded ITS was justified in terms of the improved performances for benchmark channels in Pb-Pb collisions with open charm and bottom (suppression factors and elliptic flow for D- and B- mesons reconstructed, respectively, via prompt and non-prompt \(D^0 \to K\pi\)) and charmed baryons (\(\Lambda_c\) via pK\(\pi\)). The importance of the \(\chi_c\) measurement was mentioned but not demonstrated.
c) Include a realistic estimate of the associated systematic uncertainties (as 10 nb$^{-1}$ should make statistical uncertainties sub-dominant).

Simulations were carried out to realistically determine the systematic uncertainties of ITS-based measurements of open charm and bottom, while those of the rest of physics channels were being worked out.

d) Identify clearly the fundamental QCD physics motivations of the measurement (QCD equation of state, and/or to transport/thermodynamical properties of the plasma,...) and its connection to theoretical predictions.

The underlying physics motivations were provided for most of the physics topics (except for jet studies with light-hadron identification which was under preparation).

e) Demonstrate clearly the uniqueness of the proposed measurements at the LHC, \textit{i.e.} demonstrate that the same physics goal cannot be covered through similar observables potentially measurable by ATLAS/CMS (Pb-Pb, proton-Pb) or LHCb (proton-Pb) within the next ~6 years before LS2.

ALICE informed the LHCC of ongoing discussions with heavy-ion experts nominated by the ATLAS and CMS Collaborations to evaluate the uniqueness of their proposed upgrade physics motivations. The future perspectives of high-energy heavy-ion physics at collider (RHIC, LHC) and fixed-target (FAIR, SPS, LHC) energies will be discussed in a dedicated Town Meeting organized at CERN on 29 June, 2012 aimed at providing input to the update of the European Strategy for Particle Physics in view of the updated long-range plan for particle physics in Europe (Open Symposium at Krakow, 10-12 September 2012).

f) Discuss the baseline proton-proton reference at the same centre-of-mass energy and equivalent integrated-luminosity, if needed.

Proton-proton reference measurements were justified for heavy-flavour and charmonia studies (those needed also the high-rate capabilities), but not yet for low-mass di-electrons and jets. Heavy nuclear states in Pb-Pb do not need a proton-proton baseline. Overall, the physics case for the ALICE upgrade is robust in the heavy-flavour and charmonia sectors, less so in the heavy-nuclear-state topics, and more work is needed in the low-mass di-leptons and jet measurements.

The technical aspects of the upgrade, in particular the options for ITS and TPC GEM readout, were also discussed. These upgrades are technologically demanding but are feasible. Several institutes are strongly engaged in the detailed exploration of the options. The LHCC encourages this R&D to be further pursued.

ALICE also presented their preliminary plans for installation of the upgrades during LS2. Their preferred scenario would be to cancel the 2017 heavy-ion run (compensated by a twice longer Pb-Pb run in 2016) and to proceed with the installation from the end of 2016 to the end of 2018. The TPC upgrade and surface commissioning needs 66 weeks, whereas the TRD upgrade on the surface can be done over 375 days, leaving 25 (17) weeks time between the TPC (ITS) connection and start of beam in 2019.

The LHCC \textbf{welcomes} these new developments and \textbf{encourages} ALICE to further strengthen the physics motivations for the upgrade. Upcoming milestones include a review meeting with the LHCC referees at the end of July 2012 and the submission for the September 2012 LHCC session of the ITS Conceptual Design Report and the ALICE Upgrade Letter of Intent.
5. DISCUSSION WITH CMS

Introduction

The LHCC congratulates CMS on all its achievements, and particularly on their first discovery, the observation of the $\Xi_b$, for operational improvements during the 2012 running period and for quickly producing 8 TeV centre-of-mass energy analysis results.

Status of the CMS Experiment

The CMS data-taking efficiency has improved relative to 2011 with new measures introduced to cope with Single Event Upsets and other sources of dead-time. The average data collection efficiency is 92.5%, with an active programme of work to continue implementing improvements. The data certification efficiency for the first 2.995 fb\(^{-1}\) recorded is 85% ‘All Good’ and 94% for ‘muon only’. It is expected that re-doing the reconstruction will recover an additional ~94 pb\(^{-1}\) of Electromagnetic Calorimeter (ECAL) data for ‘All Good’.

The LHC has increased the beam energy to 4 TeV and changes to beam conditions such as tighter collimation and $\beta^* = 0.6$ m have led to a higher instantaneous luminosity. The peak average pile-up PU is nearly 30 interactions/crossing. CMS had studied a PU=25 data sample taken in 2011 in preparation for 2012 running. Relative to the studies, considerable advances have been made to mitigate much of the impact of high PU on most analyses, including the Higgs search, such that the Higgs sensitivity will be higher in 2012 overall. For the 2012 run, LHC plans to increase to a peak luminosity of $8 \times 10^{33}$ Hz/cm\(^2\) with an average pile-up of up to 37 interactions/crossing at the start of a fill. CMS continues to study the impact, limitations and mitigations in all sub-detectors of running at 100 kHz in those pile-up conditions. As a side note, W&Z events were taken during a special low pile-up run with PU below 5.

The computing system usage has tracked very closely to the planned estimates with 38% live-time in collisions and with an average High Level Trigger (HLT) prompt rate of 300 Hz. The reconstruction time for peak luminosity events (at $6 \times 10^{33}$ Hz/cm\(^2\)) averages 20 s/event, which is faster than the expected performance. All Tiers of the computing are performing well. The Tier-0 farm is performing prompt reconstruction and repacking parked data, and has an average utilization of 66%. As described in the March 2012 LHCC session, CMS is parking data for analysis during the Long Shutdown 1 LS1 to accommodate an enhanced programme in B-physics searches and Higgs production via Vector Boson Fusion. The average parked data rate is 310 Hz and is being set aside; long-term Tier-1 resources are not being used for reconstruction at the current time. Simulation is progressing with 2 billion events generated and simulated, of which 1.5 billion events have been reconstructed. The Tier-2s are performing well with the expected mix of analysis and production jobs. For storage, CMS has passed a milestone of having more than 30 PB of unique files under management. CMS is pursuing some development projects including a feasibility study with CERN/IT-ES and ATLAS for developing a common analysis submission system.

Physics Analysis is progressing for the 8 TeV centre-of-mass energy data and CMS is on track to produce ~20-30 High Priority Analyses (HPA) for the International Conference on High Energy Physics (ICHEP 2012), including many Higgs channel updates. CMS also has an overall strategy for pursuing SUSY in low $E_T$ and low missing $E_T$ signals since these signatures will become very difficult and challenging at centre-of-mass energies above 13 TeV with high pile-up.

CMS plans to contribute to the update of the European Strategy for Particle Physics with several notes. Essentially all analyses from the 2011 data set will be public by the time of the Open Symposium in Krakow and all of the highest priority analyses will have been updated with 2012 data for ICHEP or shortly thereafter and can be presented. In addition, Monte Carlo studies and extrapolations from existing analyses from standard Higgs
searches and QCD benchmark scenarios will be submitted under scenarios of 3000 fb$^{-1}$ at centre-of-mass energy of 14 TeV and 300 fb$^{-1}$ at centre-of-mass energy of 33 TeV. In addition, there may be a note on use of CMS as a LEP3 detector.

**CMS Upgrade**

The CMS upgrade programme of work covers projects for LS1, Phase-1 and Phase-2. The LS1 projects are in production and include the completion of muon coverage (ME4), improved muon operation (ME1), Drift Tube (DT) detector electronics and the replacement of the Hadron Calorimeter (HCAL) photo-detectors in the Hadronic Forward Calorimeter (HF) (new photomultiplier tubes) and Hadronic Outer (HO) (silicon photomultipliers). Technical Design Reports are in preparation for the Phase-1 upgrades, the HCAL electronics upgrade and the Level-1 trigger upgrade. The Phase-2 projects will be defined in a Technical Proposal (2014) which is anticipated to include a full replacement of the Tracker, a Track Trigger, upgrades to the Forward Calorimetry and Muon systems, and possible additional trigger upgrades.

Overviews of the technical progress were given for the proposed Phase-1 four-layer Pixel Detector replacement, designed to provide robust tracking in the high pile-up environment, and the HCAL electronics upgrade to mitigate observed operational risks associated with the current photodetectors. For these projects, no major obstacles are foreseen in demonstrating physics performance and achieving detector driven specifications. These topics will be covered again in detail at the September 2012 LHCC session with the presentation of the Technical Design Reports. The LHCC notes the significant progress in all technical areas for the CMS upgrade.

The design of the Pixel Detector would enable installation during an extended technical stop of 5 months - including contingency - in 2016/2017.

CMS Physics Coordination now oversees physics studies for detector upgrades, bringing physics expertise and resources from the Physics Analysis Groups (PAGs) and treating upgrade studies with the same methodologies as used in proton-proton collision data analyses. The Simulation, Reconstruction, and Monte Carlo production activities are supported by PPD, Offline, and Computing, again analogous to the proton-proton collision data. As part of the effort, physics benchmarks have been identified that are relevant to the physics goals and will enable the benefits of the upgrades to be quantified. These benchmark samples are for the Higgs boson - $ZH \rightarrow \mu\mu b\bar{b}$ and $qqH \rightarrow qq\tau\tau$. These analyses require high muon identification efficiency, high b-tagging efficiency and good dijet mass resolution. Additional benchmark channels are SUSY signatures - stops, $\gamma\gamma + \text{Missing } E_T$ to highlight the upgraded functionality needed for Missing $E_T$ resolution, forward jet tagging capability and tau identification.

Significant progress has been made towards producing the tools and Monte Carlo samples required for detailed physics studies. Much of this progress appears to be directly attributable to the organizational change. To study the physics impact, 14 TeV full GEANT simulated samples are being produced and validated with standard and upgraded geometries for signal and backgrounds and the version of the reconstruction that includes latest developments in tracking at high pile-up. To study the impact of the proposed HCAL electronics upgrade, the jet reconstruction was (re)written to utilize longitudinal segmentation. Studies are underway with these samples in close connection with existing 7 TeV and 8 TeV centre-of-mass energy analyses, *i.e.* just “re-run” with samples used for the upgrade studies. Where necessary, however, improvements in performance of physics objects due to the upgraded detector (as measured in full simulation) will be parameterized and applied to the analyses, based on knowledge of 7 and 8 TeV centre-of-mass energy analyses. Similar samples with PU = 100 interactions/crossing are planned to be generated. The LHCC congratulates CMS on engaging the PAGs in the improved physics preparation for the upgrades.

CMS presented the anticipated review progress for Phase-1 upgrades. A CMS Conceptual Design Review will review project strategy and plans, the technical
considerations and the overview of cost and schedule. Another CMS committee will review the physics simulation studies to be included in the Technical Design Report. The CMS Finance Board sub-committee will review the cost estimate for each Technical Design Report and funding considerations for all three (including the trigger upgrade).

Following the internal review processes and physics studies, CMS will present the Technical Design Reports and summary documents for the HCAL electronics and the Pixel Detector upgrades by end of August 2012, with the intention of obtaining a positive endorsement from the LHCC in September 2012. The schedule is required to present cost information to the Resource Review Boards in October 2012 in order to obtain approval from the funding agencies to enable initial spending by the start of 2013. A series of Engineering Design Reviews are planned for 2013 to approve production designs prior to major purchases or substantial work. It is anticipated that the Level-1 Trigger Technical Design Report will follow a similar path about 6 months later, with the Engineering Design Reports in late 2013. Additional physics studies will also be performed for the Phase-1 detector with radiation-degraded performance for all detectors up to Long Shutdown 3 (LS3). The Phase-1 performance longevity will feed into the Phase-2 planning. CMS anticipates developing a Phase-2 Technical Proposal in 2014.

The schedule for endorsement is aggressive and will require that CMS holds firmly to their stated schedule for delivering the documents. In advance of the September 2012 session, the LHCC will hold meetings by phone to give preliminary feedback and questions.

6. DISCUSSION WITH TOTEM
The LHCC heard a report on TOTEM, concentrating on progress in the analysis of the 2011 data. The LHCC congratulates TOTEM on all its achievements. The status report included a report on the publication of the final measurement of \(dN/d\eta\), and the near completion of three papers documenting the final measurements of the elastic, inelastic and total cross sections from the 7 TeV data using the luminosity-independent technique. In particular, the Committee was pleased to see the consistency of the independent CMS and TOTEM measurements of the luminosity, during the special runs that led to those studies.

TOTEM reported on the successful low-luminosity runs, taken on 1 April and 2 May 2012, during which TOTEM and CMS exchanged trigger signals and collected a common data set. These data are under analysis, and is expected to lead to several scientific publications, covering topics such as \(dN/d\eta\) in the range \(|\eta|<6.5\), rapidity gap distributions, double diffraction, energy flow and mini-jet multiplicities in central and forward regions, etc. An informal joint forum for discussion and planning of these activities has been set up by the two experiments. The Committee congratulates TOTEM and CMS for these positive developments, and endorses the continuation of this joint physics programme during suitable runs in 2012.

Several actions have improved the safety and efficiency of the operation of the TOTEM Roman Pots. The software controlling the motor movements, which were unreliable for steps below 30 \(\mu\)m, has been improved, and movements are now certified to a precision below 10 \(\mu\)m. The bypass system that allows LHC running without the active status of TOTEM (or ALPHA) has been certified. The improvements to the cooling system, to ensure the safety of the detectors during LHC operations when a problem in the Roman Pot vacuum system occurs, have also been verified during a recent failure of a vacuum controller on 5 June 2012.

All detector systems, as well as trigger and DAQ, are now ready and on standby for the next data-taking or alignment runs. The LHCC strongly recommends that, after the completion of the pre-ICHEP (International Conference on High Energy Physics) high-luminosity running, all steps be taken (optics commissioning, beam-based alignment, etc) to guarantee the timeliness and success of the foreseen physics run with \(\beta^* = 90\) m optics.
In view of the progress towards common physics measurements with CMS, the Committee also supports the request to qualify the Roman Pot detectors for operation at low-$\beta^*$ and high intensity, through the needed beam-based alignment with squeezed optics. In order to minimize the time of these alignment runs, the LHCC recommends that TOTEM considers the possibility of limiting these runs to the horizontal pots only. Finally, the Committee reiterates its support to TOTEM's request to take data during a special run at the highest possible $\beta^*$, 500 m or above.

TOTEM has started preparations for work during the Long Shutdown 1 LS1, in particular regarding the T1 and T2 detectors and the relative interplay with CMS operations. All Roman Pot detectors at 147 m will be removed and kept as spares for the 220 m ones. Work has also started towards the formulation of an upgrade programme. This is focusing now on the Roman Pot detectors, in the direction of timing detectors in the sub-10 ps timing range, in order to be able to identify the collision vertex of the scattered protons under high pile-up conditions, and ultra radiation-hard pixel sensors. The Committee invites TOTEM to present a more complete overview of the scope of this upgrade programme at the next LHCC session, including the presentation of the physics case and of the ongoing R&D efforts.

7. DISCUSSION WITH ATLAS

Introduction

The LHCC congratulates ATLAS on all its achievements. The ATLAS detector is performing well and collecting data very efficiently. There are no significant detector issues to note. The upgrades are all making progress as per the plan. There is no final decision on whether to install the Insertable B-Layer (IBL) in-situ or whether to remove the Pixel Detector as part of a larger plan to also replace the Service Quarter Panels (SQPs). The experiment is executing the data-parking plan as per the discussion at the previous LHCC session. Significant effort has been spent on algorithm/trigger development that is enabling ATLAS to handle the high pile-up conditions very well. These improvements will be the foundation for the entire 2012 physics programme. Finally, computing resources are sufficient to keep up with planned data even with the high pile-up conditions. However, there is no longer any margin to spare.

Physics

In terms of physics, the experiment continues to make excellent progress. The plan is to complete the remaining 7 TeV 5 fb$^{-1}$ physics analysis programme while in parallel execute the 8 TeV programme of this year. Some of the new physics results shown in this LHCC session included $Z$ production, heavy flavour production and jet quenching in the heavy-ion data, $\Lambda_b$ mass and lifetime, measurement of the strange quark density, measurement of top-antitop spin correlation, top charge asymmetry, evidence for single top production in the $Wt$ channel, a number of SUSY searches including search for 3rd generation squarks, among others physics results.

ATLAS expects to have a broad range of results ready for the Summer Conferences, including the much-anticipated Higgs update. The experiment will try to integrate as much data as is possible and plans to update the gamma-gamma and 4-lepton channels; the two most sensitive channels in the remaining 120-130 GeV window. The Monte Carlo campaign for 4 TeV beam energy data is nearing completion.

With the accelerator running extremely well in a 50 ns bunch configuration, pile-up continues to be a challenge for the experiments to address. At the moment, ATLAS is seeing as many as 40 interactions/crossing at the start of a fill and an average of 25 interactions/crossing. Over the past number of months the experiment has made a huge investment in understanding and improving the reconstruction algorithms and the identification of physics objects in order to make them robust to physics pile-up. These algorithms were studied using 2011 data, with Monte Carlo events with many overlaid events as well as special high pile-up runs. This investment has enabled the experiment
to maintain trigger thresholds at levels quite similar to 2011 and have physics identification with comparable efficiency as 2011.

**Data-taking**

By the day of this LHCC session, (14 June), ATLAS had collected in excess of 5 fb⁻¹ of data at 4 TeV beam energy. Data-taking efficiency has been steady at 95% efficiency and the detector is working well with only a few small issues. Data quality remains high with the expectation that more than 90% of the data delivered will be good for physics. The most significant concern is with the Transition Radiation Tracker (TRT). It has developed three leaks in the last two months; one in the end-cap and two in the barrel. The total leak rate is about 4 liters of Xenon/hour, which is manageable. Flows and pressures have been adjusted accordingly such that there is no impact on physics and the calibration remains fine. A task force has been established to consider what to do should things worsen from here. The high-voltage issues of the LAr calorimeters from last year have mostly gone away and it is far less problematic now. Forty of the new, next-generation Tile Calorimeter power supplies were installed in December 2011. All of these supplies are working well and none have experienced a failure. The remaining power supplies will be installed in the LS1 long shutdown in the coming year. Shift crews will remain staffed at 9 people for the remainder of 2012 in order to ensure high data taking efficiency. Finally, the ROS (detector readout system) problem identified at the last LHCC session has been solved. New network interface cards were installed and that has stabilized the system.

There was some concern with CMS adjusting its luminosity numbers by almost 10% upward just prior to the last LHCC meeting. The experiments agreed to compare Z→μμ numbers in a very restricted central region. Based on these comparisons, it was confirmed that CMS did get 8% more luminosity than ATLAS. The comparison for 2012 is now going on – in principle this can be done on a fill-by-fill basis.

**Trigger**

The ATLAS trigger is working well. At the start of fills, the Level-1 system is typically operating at 65 kHz and Level-1 is currently capable of 75 kHz. Level-2 is operating at 5 kHz and the physics output stream of Level-3 is about 540 Hz. Of that 540 Hz, about 400 Hz services the three primary physics streams and an additional 140 Hz is data that is being parked and written to tape. Since last autumn, significant new improvements have been made to the Missing Transverse Energy (MET) triggers. The new noise cuts allow the MET trigger thresholds to remain as low as 40 GeV in what is a much more challenging environment. The Level-2 trigger is now using energy sums from calorimeter front-end boards in order to improve MET. Other physics triggers have thresholds similar to 2011 running – as examples, 24 GeV for single high-p_T leptons and 12 GeV for di-leptons - thanks to algorithms that are now much more robust with regards to pile-up.

**Offline**

Tier-0 CPU resources now on the floor are almost double the capacity of last year. This has enabled the experiment to keep up with data-taking in these challenging high pile-up events. The increases in Tier-1 and Tier-2 resources are much less dramatic. The experiment is currently running about 120,000 to 140,000 concurrent jobs on the Worldwide LHC Computing Grid (WLCG) – about 70% of those are part of the Monte Carlo campaign and the remainder is for physics analysis. As a heads-up, ATLAS would like to hold its trigger menu constant even after the LS1 long shutdown. This would require Level-1 to operate at about 100 kHz output. This would then imply a Level-3 output of about 1 kHz. The experiment would like to present a case for increasing the trigger rates as they attempt to optimize the physics output and not be constrained by estimates made years ago with insufficient information.

The offline systems will remain heavily used during LS1. The experiment not only will process its “parked” data but also has plans to reprocess the entire data set in 2013. In addition, there will be significant demand to begin a simulation campaign at the new
energy as well as to understand the pile-up issues, which could be as large as 140 interactions/crossing.

**ATLAS Upgrade**

Preparation of the Phase-1 Letter of Intent is progressing. ATLAS’ plans and funding schemes were well received at the ATLAS Resources Review Board and the deliberations were a solid path forward. Discussions have now shifted to how to share projects across funding agencies. Preliminary expressions of interest by the Institutes indicate a total cost of about 36 MCHF that will be covered. The primary cost drivers of this upgrade include the muon small wheels and the trigger improvements, which include the calorimeter electronics necessary for triggering. An Addendum to the IBL Technical Design Report has been prepared, closing the loops on a number of issues left open in the first version of the document. There are no outstanding issues and the LHCC is happy to sign off on this version as final. No final decision has been made yet with regards to the SQP replacement as part of the IBL installation. The Committee recently met and gave the experiment a number of exercises to ensure that there is sufficient quality control and safety margin to guarantee that the system returned will be at least as good as it is right now. If sufficient quality control can be demonstrated then the SQP will be replaced. If not, the IBL will be inserted in-situ using techniques already demonstrated on mock-ups to work.

**8. DISCUSSION WITH LHCb**

**Status of the LHCb Experiment**

The LHCC congratulates LHCb on all its achievements. The start of the new data-taking period at centre-of-mass energy 8 TeV was very fast and the LHCb Collaboration required only a short time to achieve stable and optimized running conditions. Initially, the only limiting problem was the adjustment and tuning of the High Level Trigger (HLT) tasks to the new energy, which were completed soon after the first technical stop. Since then, the LHCb experiment has acquired data with an average dead-time of ~2% and a data-taking efficiency of ~93%. The collected data have a very high quality, as demonstrated by the excellent reconstruction performance seen in the first pass (for example, the mass resolution on \( \Upsilon (1S) \), which is now 43 MeV). The typical times needed for setting up operations were: (i) 4 minutes to power and close the Vertex Locator (VELO) after the declaration of stable beam, and (ii) a luminosity ramp-up in 7 minutes after completion of beam optimization. In the last 34 days, LHCb has succeeded in running with luminosity levelling at \( 4 \times 10^{32} \text{ cm}^{-2} \text{s}^{-1} \), as planned, and integrating 424 pb\(^{-1}\). Extrapolating this over the remaining physics days, LHCb is still on track to collect a total of 1.5 fb\(^{-1}\) during this calendar year. They also expect to take part in the proton-Pb run.

The scheme for deferred HLT triggers has become a reality. This had been proposed to increment the through-put to disk by about 10%, and thus achieve an overall HLT output rate of 4.5 kHz by storing an additional fraction of raw data on the local disks and processing them with the online farm during inter-fill periods. The scheme works as planned and the fraction of additional delayed triggers can still be increased (by up to 20%) thanks to a much larger disk space provided to each node (from 200 GB to 1 TB).

LHCb is now running with a vertical crossing angle so as to decouple from the plane of the LHCb magnet polarity swaps. There were a few problems during the first tests of this swap, but thanks to the work done by the LHC experts, it has now become a routine operation. A requirement for three polarity switches, in between technical stops, corresponding to 2x2 equivalent data sets of ~150 pb\(^{-1}\), has been performed for the study of the reconstruction and running systematics.

The LHCC congratulates the LHCb collaboration again for the impressive and high quality physics results produced. To date 56 papers have been either submitted, accepted or published in refereed journals, as compared to a total of 42 shown at the previous
One of the highlights presented has been the great start in the search for Charged Lepton Flavour Violation. LHCb looked for the decay $\tau \rightarrow \mu \mu \mu$ in 1 fb$^{-1}$ of data. The candidates in the $\tau$ mass window were in good agreement with expected background and by normalizing to $D_s \rightarrow \phi(\mu \mu) \pi$ events, they were able to set a branching fraction limit of $6.3 \times 10^{-8}$ at 90 \% C.L., which is only a factor 3 (2) higher than the limits set by Belle (BaBar). The processing plans for 2012 are proceeding as expected and the complete re-processing of the entire 2012 data sample will happen only at the end of this year.

**LHCb Upgrade**

Progress towards the upgrade was summarized by the LHCb Collaboration with dedicated presentations on the tracker, particle identification systems, scheduling and cost. Also, the LHCC took note that the LHCb Collaboration has released, in due time before the LHCC session, the Framework Technical Design Report (FTDR). The FTDR is divided into three main chapters.

In the first introductory chapter of the FTDR, an update of the expected physics performance and of running requirements is reported, re-emphasizing the motivation for the upgrade. The plan is to have the upgrade ready for the Long Shutdown 2 (LS2) and then, after 1.5 years of installation, start a 10-year run at luminosity $\sim 10^{33}$ cm$^{-2}$ s$^{-1}$. The aim is to acquire 50 fb$^{-1}$, i.e. ten times that which will be integrated by LHCb up to 2018. A consistent improvement in the yield, especially for hadronic triggers, will be provided by reading out the detector at 40 MHz and substituting the 1 MHz limited Level-0 trigger with a more efficient Low Level Trigger. The expected physics output foresees large improvements in most of the fields specific to LHCb, including $B_s$ mixing, the measurement of the unitarity triangle angles, and charm CP violation. In most cases, the errors are statistically limited and the upgrade will be able to lower them to values very close to the theoretical uncertainties. Additional documentation on the physics will be reported in the physics paper *Implication of LHCb measurements and future prospects*, which is being released and will be used as input for the update of European Strategy for Particle Physics.

The second chapter describes the evolution of the R&D for all subsystems since the Letter of Intent. One of the most relevant differences with respect to the Letter of Intent is the requirement that the detector components to be upgraded should be able to sustain a luminosity of up to $2 \times 10^{33}$ cm$^{-2}$ s$^{-1}$. The LHCC recognizes the importance of this decision, since the running experience of LHCb so far has shown a continuous improvement in luminosity levelling without affecting the physics performance. Therefore, it is of the utmost importance to avoid the need for further modifications to the new detectors during a second phase. Further studies are still needed to clarify how the unchanged LHCb components, mainly the calorimeter and the muon system, could survive if such a luminosity were reached. Another relevant point discussed is the possibility of reducing the inner radius of the VELO detector, which could substantially improve the resolution of the vertex measurement. This option is interesting, but still needs to be discussed with LHC machine experts to check its viability.

The third chapter reports, both for each subsystem and for the common projects, a breakdown of the schedule and cost. So far, all detector alternatives have been evaluated independently. Supplementary information to the schedule has been shown in standard GANTT format with the main milestones for the Technical Design Reports, Engineering Design Reports and the Production Readiness Reviews. Most of the specific Technical Design Reports are expected to be completed by the end of 2013, while most of the Production Readiness Reviews will be ready for the end of 2015 or beginning of 2016. No systems are on the critical path, assuming the Technical Design Reports are completed on time and assuming the milestones for upgrading the electronics are met. All subsystems can be completed by the beginning of 2018. The online system is the only one that has the Technical Design Report scheduled for the first quarter of 2016, since most of the equipment will be available off the shelf. The overall LHCb upgrade
installation schedule is tight. The LHCb Collaboration assumes 18 months total work time, with 6 months to disassemble the beam-pipe, 12 months to install the detector components and 2 months to re-install the beam-pipe. The critical path is in the installation of the tracker. The total cost has been evaluated for each sub-detector without including the R&D costs and including an average of 15% contingency. The cost is broken down by detector, but at present without a spending profile. The total cost envelope is 57.5 MCHF, which includes a contingency of 3.5 MCHF for the eventual modification of the muon and calorimeter systems. The common project, online, infrastructure and common electronics amount to a total of 15.7 MCHF. Differences among alternative solutions offer possible savings of 2.1 MCHF. The interests of the collaborating institutions in the various items for the upgrade have also been specified. The LHCC recommends that LHCb provide a more detailed breakdown of the costs, with a spending profile and an overall estimate of the manpower required, separately by sub-detector.

The LHCC acknowledges the high quality of the work done for the FTDR and will examine it further for a more detailed evaluation. A more technical meeting will be scheduled before the September LHCC session, at which time the LHCC plans to deliberate. The final decision among alternative solutions should be based, wherever feasible, on simulation and reconstruction studies, given the marginal difference in the apparent costs.

9. DISCUSSION WITH LHCf

The LHCC congratulates the LHCf Collaboration for the continued progress in the data analysis, with results of the data collected at 7 TeV having been shown. In particular, the transverse energy spectrum of neutral pions in different rapidity bins has been presented. The comparison of the data with Monte Carlo shows that two of the selected models (DPMJET 3.04 & PYTHIA 8.145) have an overall agreement with the data in the 9.2<abs(y)<9.6 and pT <0.25 GeV/c bins, while at higher pT the production rates of the models are larger in comparison with the data. The model SIBYLL 2.1 predicts harder pion spectra than the data, but the expected neutral pion yield is generally small. The model QGSJET II-03 predicts neutral pion spectra that are softer than the LHCf data. Finally, the model EPOS 1.99 shows the best overall agreement with the LHCf data.

The average transverse momentum as a function of the rapidity has also been shown. Comparison with UA7 results shows that the LHCf data exhibit the same trend. Monte Carlo comparison shows good agreement with the EPOS 1.99 model. No dependence on the center-of-mass energy is evident.

The LHCf Collaboration has started to also look at neutron events and first data quality plots have been shown. Such events are of crucial importance for analysis of cosmic-rays, particularly after the excess of muons revealed by the AUGER experiment with respect to Monte Carlo predictions for protons and iron. Efficiency and energy resolution distributions for neutrons have been presented, showing a flat efficiency of 75% and an energy resolution of about 36% above 500 GeV. Work is ongoing to improve the energy resolution.

Three physics papers have been completed, consisting of the analysis results of inclusive neutral pions at 900 GeV and 7 TeV and the transverse momentum spectra versus rapidity.

The LHCf detector upgrade for the 14 TeV proton-proton run has been presented. Plastic scintillators will be replaced with GSO scintillator crystal bars due to the better radiation hardness properties of the latter. Production is finished in Japan and beam tests at an ion facility are underway. The reassembly of Arm-1 will start at the end of June 2012 in Florence and the same procedure will be applied for Arm-2 in 2013. A beam test of the Arm-1 is foreseen for August 2012.

Arm-2 will be reinstalled in the TAN absorber at the end of the proton-proton run during a technical stop. The support and cabling have been modified to allow for a short time
installation of the detector and the installation procedure is well defined. The experiment will collect data during the upcoming proton-Pb run with only Arm-2.

The Committee recommends that LHCf establishes a more formal interaction with ATLAS in order to explore the physics potential, the desirability and the required planning of a possible collaboration to combine data collected in the forward region by the LHCf detector with central data collected in ATLAS for the study of the transverse momentum spectra as function of the centrality. The Committee suggests that this discussion, under the supervision of the physics coordination of the two experiments, be initiated as soon as possible, possibly within July 2012, with a dedicated meeting between experts from the two collaborations.

10. REPORT & DISCUSSION WITH LHC EXPERIMENT UPGRADE REFEREES

The LHCC heard a report from the LHC experiment upgrade referees, concentrating on the upgrade plans for ATLAS, ALICE and LHCb.

The referee provided a summary of the preliminary LHC 10-year plan and gave an overview of the injector upgrade schedule.

The Committee also heard a status report on the ATLAS, ALICE and LHCb upgrade plans. An Addendum to the Insertable B-Layer (IBL) Technical Design Report (TDR) was submitted by ATLAS to the LHCC (CERN-LHCC-2012009, ATLAS TDR 19 ADD 1). The Addendum describes an IBL detector consisting of mixed sensor staves (75% planar in the central region and 25% 3D in the end regions), a diamond-based beam monitoring system and an accelerated schedule, with installation in 2013 rather than 2015. ALICE has prepared a Conceptual Design Report for the upgrade of the Inner Tracker System (ITS) and also a document on the experiment’s upgrade strategy for running at high rate. LHCb has submitted to the LHCC its Upgrade Framework TDR (CERN-LHCC 2012-007, LHCb TDR 12), in which details of the upgrade goals, R&D work undertaken since the Letter of Intent and an account of the schedule, costs and participating institutes is given.

The LHCC also discussed the work ahead, with a number of upgrade documents to be reviewed by the Committee in the coming two years.

REPORT & DISCUSSION WITH THE WLCG REFEREES

The LHCC congratulates the Worldwide LHC Computing Grid (WLCG) team and the experiments on their continued impressive performance. Since the last session of the LHCC, the 2012 proton-proton run has started at a centre-of-mass energy of 8 TeV, with a higher peak luminosity than in 2011 and with increasing levels of pile-up in ATLAS and CMS. Up to the end of May 2012 a total of 9.4 PB had been written to tape at Tier-0 in 2012 (including non-LHC experiments), with 3 PB in May 2012 alone, compared to an average of 2 PB/month in 2011. This increase is due to the larger event sizes at higher pile-up and additional so-called “dark data” being recorded, but then “parked” for reconstruction later. The Committee supports the continuing efforts of the experiments to develop flexible strategies to optimize physics productivity, while operating within the limits imposed by the funding available. They have done this by improving the speed and efficiency of reconstruction and analysis code, limiting the size and number of copies of stored data, and making full use of any additional resources that become available. One example of this is that experiments plan to exploit some CPU resources from their online High Level Trigger (HLT) farms for offline processing during the Long Shutdown 1 LS1. In some cases such usage incurs additional expense, however, because of the need to continue operation of cooling and other services during LS1, and in general these resources are most suitable for Monte Carlo production, rather than data reprocessing.

ALICE has reprocessed most of the 2011 data (Pb-Pb and proton-proton) and is currently producing large Monte Carlo samples, along with the 2012 reconstruction and user analysis. The CPU efficiency for production jobs is over 80%, but about a third of the
total CPU is for user analysis jobs, where the average efficiency is 30% with large variations because these tend to be I/O intensive. To improve this, “analysis trains” have been introduced, grouping together several user analysis tasks (“wagons”) into a single set of Grid jobs. These read in the hundreds of TB of data only once, to be processed by each of the analysis tasks in turn, increasing the CPU efficiency to ~60%. Storage remains critical, with continuous deletion of old files and fewer copies of new ones. Ongoing installation of 2012 pledged resources is helping, with excellent performance and support from all the Tiers.

ATLAS has recorded data at ~1 GB/s at peak rate, higher than in 2011. Pile-up causes the processing time per event to increase, although this has been mitigated by software optimization. Grid processing has been able to keep up by making use of additional installed resources, beyond those pledged for 2012. These have also allowed sufficient Monte Carlo production at 8 TeV with high pile-up conditions, as needed to analyze the 2012 data. Planning for software and computing work during LS1 is underway, which will allow ATLAS to continue to make efficient use of resources in 2015 and beyond, including new hardware architectures.

For CMS the average trigger rate in 2012 has been about 300 Hz, higher at the start and lower at the end of a fill, and roughly as planned. An average 310 Hz has been recorded as parked data, so far only for long-term storage, to be reconstructed during LS1. 10% of the parked data are monitored for data quality checks. Tier-0 is coping well with prompt reconstruction and repacking of parked data. Tier-2 resources are busy producing Monte Carlo simulated events at 8 TeV. Work is underway to allow more efficient access to small data samples, and to develop common analysis workflow submission tools.

LHCb records roughly 1 TB of data for each pb⁻¹ of integrated luminosity in 2012, about 25% more than initially estimated. Track quality is much improved, giving a higher K⁺/K⁻ efficiency.

Events have higher multiplicity, due to the increased collision energy and pile-up, leading to longer reconstruction and stripping times, which have been partially mitigated by retuning the track and event selection cuts. Increased memory consumption remains a problem that requires further optimization. Tier-1 resources are heavily used for reconstruction, leading to more reliance on Tier-2 resources for reprocessing. Monte Carlo production for analysis of 2011 data has been ongoing since December 2011, together with preliminary samples for 2012. All this year’s data will be reprocessed in the last three months of 2012. Further optimization of data storage, including filtering and stripping of Monte Carlo, review of the SDST data format, and improved data placement, are being commissioned or planned to allow more efficient disk and tape usage.

Plans for the new Wigner Data Centre in Budapest are being developed. The contract was signed in May 2012 and is for 3 years, extendable annually up to a total of 7 years. It is an independent site for hosting, supporting, operating and maintaining CERN equipment, providing an extension to the existing CERN Computer Centre building, which is limited by its power capacity, and making business continuity possible in the case of catastrophic failure in the current building. The new centre will have a maximum of 2.7 MW capacity, with UPS and diesel backup, and two independent 100 Gb Ethernet connections to CERN for <10 ms latency. The aim is to provide a transparent extension to the CERN Computer Centre, which will not be visible to users. Installation of equipment will start in 2013, with a goal of early 2014 to go into production.

Reports from the WLCG technical working groups looking at the future of Data and Storage Management, Workload Management, Databases, Security, and Operations and Tools are now available.
11. REPORT ON RD39

The LHCC heard a report from the RD39 referee on the Collaboration’s programme concerning the operation of solid-state detectors at low temperatures and in a high radiation environment. The referee summarized the experimental results that RD39 has achieved on the development of such detectors and also described the proposed programme for future work.

The Committee took note of the progress in the study of such cryogenic devices for applications in future high-energy physics experiments. Although the 3D trenched-Charge Injection Devices (CIDs) promise good charge collection efficiency beyond $10^{16}$ n$_{eq}$/cm$^2$, no new measurements were made during the past two years. Reference data were taken in beam tests in November 2010 and test beams on irradiated sensors are pending on samples still deactivating. Applications of silicon detectors at 1.9 K for the machine Beam Loss Monitors (BLMs) remains an interesting project and beam tests and irradiation campaigns are scheduled for the second half of 2012. RD39 has also developed procedures and techniques to test silicon sensors at cryogenic temperatures.

The LHCC considers that the proposed work-plan for next year, concentrating on the production, qualification, irradiation and beam tests of 3D trenched CIDs, is reasonable. The Committee also took note of the RD39 request for office space at CERN.

The Committee concluded that the development of CID is slow and the technology is not yet considered as an option for an LHC detector upgrade. Although the RD39 Collaboration is a small group, it does possess special knowledge and techniques and the RD39 programme of study of radiation-hard silicon sensors operated at cryogenic temperatures - CID and applications to the LHC machine – is worth continuing. Emphasis should be placed on the development of the machine BLM while the R&D on the CID sensors should be progressively integrated into RD50.

In view of the above and given the modest request for resources for further work, the referee recommends that the R&D project be continued in 2012. A status report is expected to be submitted to the LHCC in one year’s time. The Committee agrees to the continuation of the project on this basis.

12. REPORT ON RD42

The LHCC heard a report from the RD42 referees on its programme to develop intrinsically radiation-hard Chemical Vapor Deposition (CVD) diamond tracking detectors for experiments at high luminosity colliders. The RD42 Collaboration has about 100 members from 30 institutions. Two main technologies are being pursued: poly-crystalline CVD (pCVD) and single-crystal CVD (scCVD) diamond sensors. The Collaboration has focused its efforts in the last year on the continued development of both technologies and on finding additional suppliers for production devices that meet the experiments’ specifications. The Collaboration reported that one of their main suppliers, Diamond Detectors Ltd. (DDL), has ceased operation. They are now negotiating with DDL’s parent company Element Six Ltd. to continue production. Good devices have been obtained from the company II-VI Inc. with collection distances expected to exceed 500 µm. Radiation damage analysis has been continued over the last year and results have been compared to both non-ionizing energy loss (NIEL) calculations and models based on Displacement Per Atom (DPA) scaling.

The Collaboration reported on the performance of the diamond Beam Conditioning Monitor (BCM) installed in the ATLAS experiment. They are to be congratulated on the successful operation of this device and its implementation as the standard luminosity monitor for the experiment, which has been key to obtaining a small luminosity uncertainty. Building on this success and the synergy with the ATLAS Insertable B-Layer (IBL) project, the Collaboration proposes to build a Diamond Beam Monitor (DBM) for the ATLAS experiment consisting of four 3-plane pixelated pCVD diamond stations on each side of the ATLAS experiment. Three test beam campaigns were held with prototype devices to gain experience. The goal is to install the DBM during Long
Shutdown 1 (LS1). The Precision Luminosity Telescope (PLT) for CMS, using smaller scCVD sensors, is also nearing completion.

The role of the RD42 Collaboration in developing pixelated diamond sensors for the community is well established and its benefit to the community has been clearly demonstrated. The LHCC considers that the proposed research programme for next year is reasonable. The research programme includes the continuation of irradiation studies of both pCVD and scCVD diamond sensors; the characterization of irradiated samples in test beams; continuation of the development of additional diamond manufacturers to expand production capabilities; the installation of the DBM in ATLAS; and the completion of the PLT for CMS. In order to continue their research programme, the RD42 Collaboration requests that the CERN RD42 group be maintained; that CERN continues to support the RD42 research programme with 25 kCHF; and access continues to CERN facilities. It is noted that the financial contribution from CERN, although not absolutely necessary, may leverage requests to external funding agencies. The Committee notes that the RD42 research programme immediately benefits the LHC experiments and fully supports its continued research programme.

Under the above terms, the referees recommend that the RD42 project be continued in 2012. A status report is expected to be submitted to the LHCC in one year’s time. The Committee agrees to the continuation of the project on this basis.

13. REPORT ON RD50

The LHCC heard a report from the RD50 referee on the Collaboration’s programme concerning the development of radiation-hard semiconductor devices for very high luminosity colliders. The referee summarized the experimental results that RD50 has achieved on the development of such detectors and also described the proposed programme for future work.

The Committee took note of the good progress in the study of such devices for applications in future high energy physics experiments, such as those at an upgraded LHC. A number of new results were presented, including understanding radiation damage effects at the microscopic level, measurements related to charge multiplication (geometry and simulations), and new ideas and structures (slim edges project, 3D stripixel sensors, and low-resistance strip project). New common tools have also been advanced, including Edge Transient Current Techniques (Edge-TCT) and ALIBAVA. The former technique consists of illuminating with a laser the silicon sensor from the side and scanning across the detector thickness to measure the charge and induced current as a function of depth, resulting in the reconstruction of the electric field. ALIBAVA is a common tool that will enable RD50 groups to investigate strip sensors with LHC-like electronics.

The LHCC considers that the proposed work plan for 2012 is reasonable. Work is planned to be carried across all fields of study – detector and material characterization; new structures; full detector systems and the continuation of links to the LHC experiments. The Committee also took note of the financial support through the PH Department R&D funding and the continuing use of laboratory, infrastructure and technical support from CERN.

In view of the above and given the modest request for resources for further work, the referee recommends that the R&D project be continued in 2012. A status report is expected to be submitted to the LHCC in one year’s time. The Committee agrees to the continuation of the project on this basis.
14. REPORT ON RD51

RD51 reported to the LHCC on its programme to develop advanced gas-avalanche Micro-Pattern Gas Detector (MPGD) Technologies. RD51 was established in 2008 with a main objective to facilitate and advance the technological development of MPGDs and associated electronic-readout systems for applications in basic and applied research. The group serves as an access point to the MPGD technology for the worldwide community and its research focus has been on the development of techniques for detectors in high-rate environments while improving the space-point resolution and the radiation hardness of the detectors.

The Collaboration has about 450 people from 80 institutes organized around seven working groups. The main technologies being pursued are Micro-Mesh Gas Detectors (Micromegas), thin and thick Gas Electron Multiplier (GEM) devices, detectors with CMOS pixels and micro-pixel chambers. The deployment of the MPGD technology in running experiments has increased substantially and RD51 serves a very broad user community.

The Committee took note of some significant breakthroughs in the development of the technology. The Collaboration has successfully developed the resistive bulk Micromegas technology. The idea of resistive strips parallel to the readout strips has enabled the fabrication of detectors with good uniformity, robustness, easy fabrication, small dead areas and spark suppression. For the fabrication of GEM chambers, a single mask GEM technology with self-stretching foils has been developed. Further improvements in chamber assembly techniques have reduced the construction time from three days to two hours and allows for the cost-effective construction of large-area GEM planes. These developments have paved the way to large-area, large-scale industrial production of chambers, which is exactly what is needed for the LHC experiments. Contacts with industry have been established for industrial production.

The Collaboration has also developed a scalable readout system as interface with many available front-end readout chips, such as the APV25, VFAT, Beetle or TimePix ASIC, for the community to use. This has created a very low threshold for the community to enter into the area of development of gaseous detectors for systems ranging from a few to a large number of channels. This technology has been successfully transferred to industry and the readout system will be commercially available through the CERN shop. About twenty user-groups worldwide are using the system.

The development of the software for simulation of avalanche gas detectors is fully supported through internal funds of the Collaboration. The software packages of Garfield++ and Magboltz were improved and are maintained within the Collaboration. Cross sections for gaseous processes are updated in collaboration with other institutions. These tools are critical for the fundamental understanding of the performance of MPGDs and as such, RD51 provides a crucial support role for the whole user community.

The Collaboration reported on the upgrade of the detector workshop. Equipment has been purchased and installation will be completed by September 2012 for the fabrication of $2 \times 1 \text{ m}^2$ bulk Micromegas and $2 \times 0.5 \text{ m}^2$ GEM chambers. This facility will provide experiments with the tools, in-house expertise and support to fabricate large-scale detectors. Despite this development, the Collaboration expressed its concern that it is an R&D collaboration and it neither has the means, nor is it its mission to be in charge of the fabrication of production devices for approved experiments. The Collaboration is actively involved in the transfer of the technology to industry to be able to remain focused on its core mission.

Two additional areas of community support were reported on. The Collaboration provides the infrastructure and coordination for three 2-week test beam runs at CERN for the community at large to test MPGDs. This maximizes the efficiency of the groups taking high-quality data. The second area is in education. Classes are organized for the
use of the software and the group has strong participation in the EDIT detector schools to train younger physicists.

The very successful R&D programme of RD51 has been targeted towards the development of large-area detectors, needed for example by the LHC experiments. The group has achieved several breakthroughs in this area. Overall, RD51 is a very valuable resource to the community at large not only through the development of the technology but also through the development and support of scalable readout, simulation packages for avalanche detectors, instrumentation of test beam facilities and their coordination, and the active transfer of the technology to industry. They also assume the responsibility to train physicists in the use of the simulation tools and the physics of MPGDs. The Collaboration wants to continue the R&D following the path set over the last few years and requests limited support for the continuation of access to the RD51 test beam facility and to keep the “semi-permanent” set-up and extra beam time; access to the CERN MPGD printed-circuit workshop with associate manpower in support of technical maintenance and further development of MPGD technologies; access to central computing resources for MPGD simulations and some office space. The Committee congratulates the Collaboration on their successes and is looking forward to receiving their official request for a five-year extension of the programme by the end of this year well in time for the official end of their term in December 2013.

In view of the above and given the modest request for resources for further work, the referees recommend that the RD51 R&D project be continued in 2012. A status report is expected to be submitted to the LHCC in one year’s time. The Committee agrees to the continuation of the project on this basis.

15. CLOSE-OUT WITH THE DIRECTOR-GENERAL

The LHCC informed and discussed with the Director-General the status of the experiments and their plans for the future. Amongst the issues discussed were the LHC machine and experiment status, and the ongoing work and preparations for the upgrades of the LHC experiments. Moreover, further strengthening of the links between the LHCC and the Resource Review Boards, including with the latter’s scrutiny groups, should be made.

16. REFEREES

The Committee discussed the future membership of the Committee.

The LHCC referee teams are as follows:
ALICE: J.-C. Brient, D. D’Enterria, W. Kuehn (Co-ordinator)
CMS: A. Boehnlein (Co-ordinator), M. Demarteau, T. Mori, A. Nomerotski
LHCb: C. Hawkes, S. Miscetti (Co-ordinator), T. Sjöstrand
TOTEM, LHCf, MoEDAL: U. Bassler, C. Cecchi, D. D’Enterria, M. Mangano
LCG: A. Boehnlein, J.-C. Brient, C. Hawkes (Co-ordinator), T. Mori, T. Sjöstrand

Experiment Upgrades:
   General: J.-C. Brient, D. Pitzl (Co-ordinator)
   RD39: D. Pitzl
   RD42: M. Demarteau, A. Nomerotski
   RD50: A. Nomerotski
   RD51: M. Demarteau, W. Kuehn
17. The LHCC received the following documents:

- Minutes of the 109th meeting held on Wednesday and Thursday, 21 & 22 March 2012 - CERN-LHCC-2012-006

- Upgrade Strategy for ALICE at High Rate - CERN-LHCC-2012-004

- Conceptual Design Report for the Upgrade of the ALICE ITS - CERN-LHCC-2012-005


- Framework TDR for the LHCb Upgrade - CERN-LHCC-2012-007

18. DATES FOR LHCC MEETINGS

Dates for 2012

26-27 September
5-6 December

Emmanuel Tsesmelis
E-mail: LHCC.Secretary@cern.ch
Tel. 78949, 164057

LHCC Secretariat: Morna Robillard (Bldg. 3/R-012) Tel. 73224
Morna.Robillard@cern.ch
Minutes on the 106th Meeting of the SPSC  
Held on Tuesday 26 June and Wednesday 27 June 2012

OPEN SESSION

1. Status and plans of the COMPASS experiment  Andrea Bressan
2. Status and plans of the ICARUS experiment  Jan Kisiel
3. Status and plans of the OPERA experiment  Mitsuhiro Nakamura
4. Expression of interest for a very long baseline neutrino oscillation experiment (LBNO)  André Rubbia
5. Direct high-precision measurement of the g-Factor of a single Antiproton stored in a cryogenic penning trap  Stefan Ulmer

CLOSED SESSION

Present:
S. Bertolucci\(^1\), P. Bloch\(^1\), H. Breuker, O. Cremonesi, A. Denig\(^1\), M. Diehl, E. Falk, L. Favart, L. Gatignon, I. Irastorza, A. Jokinen, T. Lasserre\(^1\), S. Maury, B. Panzer-Steindl, L. Ramello, M. Rozanska, C. Rembser (scientific secretary), E. Rondio, N. Severijns, C. Touramanis\(^1\), C. Vallée (Chair), U. Wiedemann, I. Wingerter-Seez, M. Wing\(^1\)

\(^1\)Present on Tuesday only

Apologies:
P. Collier
1. MINUTES OF THE 105\textsuperscript{th} MEETING OF THE SPSC HELD ON 3 APRIL AND 4 APRIL 2012

The minutes of SPSC105 were approved (CERN-SPSC-2012-016, SPSC-105).

2. CHAIRMAN’S REPORT FROM RB200

The Chairman reported on the 200\textsuperscript{th} meeting of the Research Board held on 30 May 2012.

The following points were presented and, where necessary, discussed:

1) The SPSC presented the final measurement from NA62 of the RK ratio as well as the good progress in hardware developments for the K$\rightarrow$\textpi\nu\nu measurement.

2) The SPSC reported the problems affecting the DIRAC 2011 data sample as well as remedies implemented in 2012 to circumvent them, and expressed its encouragements to proceed on a timely analysis and publication of the 2008-2010 data.

3) The Committee congratulated the CLOUD collaboration for their widely recognised results from 2010 and 2011, and presented the prospects for the 2012 run.

4) The SPSC showed the results obtained by the RD52/DREAM calorimetry Collaboration in 2011, as well as their plans for further beam tests in 2012.

5) The Committee presented the positive spin filtering results obtained by the PAX Collaboration with protons at COSY. It however expressed its recommendation not to install the experiment on the AD, to avoid disruptive interference with the increased activities scheduled on this facility in the coming years.

6) The SPSC presented the combined ICARUS+NESSIE proposal (P347) for a neutrino short baseline experiment on the SPS. The Committee expressed its recognition of the physics potential of the project, encouraged the Collaboration to strengthen and asked CERN to further study the design of the beam.

The Research Board noted points 1) to 4) and 6) and endorsed point 5).
The Research Board also approved the GBAR experiment and the extension of the AD hall, with a workload adapted such that the ELENA construction will be longer by one year.

3. STATUS OF ACCELERATORS

S. Maury summarised the operation and performance of the injector accelerators. Both accelerators, the LINAC2 and the PS Booster, are efficiently delivering beams to all injectors and facilities with high intensity since the beginning of this year.

Also the PS is operating very well in 2012. High intensity beams from the LINAC and the Booster were causing frequent radiation alarms when producing PS beams for the CNGS and nTOF facilities. Thus, to keep the radiation level below the accepted limit, the number of PS cycles for CNGS was reduced and the intensity kept below $2 \times 10^{13}$ protons per extraction. However, by significantly reducing the appearance of fluctuations of the field of a vertical recombination septum magnet, the intensity of the nTOF beam could be increased again keeping the dose rate acceptable below the limit. So, it was decided to reduce the number of nTOF cycles in order to increase the CNGS performance.

The availability of SPS beams in 2012 for the fixed-target and neutrino programmes was high, 86% for the fixed-target and 77% for the CNGS experiments. The main problems, which were causing losses of available beam time, were a defect in a sextupole magnet, which needed 1 day of repair and ventilation problems in the CNGS target area, which needed about 3 days to be fixed. During 10 days the CNGS beam was operated in bunched mode to provide 100ns beam to the neutrino experiments at LNGS for the measurement of the neutrino time-of-flight from CERN to Gran Sasso.

The start-up of the AD was successful and the machine is delivering high quality beams to the experiments.

4. STATUS OF EXPERIMENTAL AREAS

L. Gatignon reported on the operation of the experimental facilities at the PS (East Area), AD and SPS (North Area and CNGS).

The various magnet repairs have been completed in time and the East Area operation for the test beams has started as scheduled on Monday 16th of April. Since then the operation of experiments and beam tests in the area is smooth. The T9 and T10 beams served already a multitude of users, in particular CLIC-
BPM, CALICE SDHCAL and WHCAL, CRYOBLM, TWICE and ALICE FOCAL in T9 and several ALICE groups (TOF, VHMPID, FARICH), NA61-TESTS and SCINTFIB in T10.

The DIRAC experiment has suffered from delays in the delivery of their new permanent magnet, which was installed mid-June only but allowed DIRAC to start on 21 June 2012.

The CLOUD experiment started data taking with beam on 20 June, about two weeks later than scheduled. Reason was the intensive commissioning of the expansion system on their reaction chamber, which is now in full operation. CLOUD now has a system to produce ultra-clean water from Oxygen and Hydrogen gasses to ensure that the purity of the water added to the chamber gas is excellent.

Some resources have been allocated for the East Area upgrade during 2013 and 2014 to proceed with the crane upgrade, the migration to a new radio protection control system (RAMSES), the dismantle DIRAC experiment and to move and upgrade the IRRAD irradiation facility to the present DIRAC location. All shutdown work and preparations for the SPS beam-lines and experimental facilities were successfully done and beams were sent to the users without major delays.

The motors of the tables of the main beam dump collimators (TAX, Target Attenuators experimental areas) behind the T2 and T4 targets were repaired and the radiation dose to which the workers were exposed, was measured to be well below the dose limit agreed by the ALARA L3 Committee. Thus in view of overall dose and work optimisation it was decided to also repair the tables behind the T6 target. This work also went very smoothly and all 12 TAX’es were fully operational in the beginning of May. The extra workload put additional strain on the teams involved and other shutdown work was delayed. In particular the detection and repair of vacuum leaks in the M2 beam line for COMPASS, as well as the preparation and installation of two new critical collimators in TCC2, also in the COMPASS beam. As a consequence, the beam lines were operational only in the evening of Monday 7 May 2012. However, the beam permit was signed only a day later, due to problems with the Beam Imminent Warning panels, for which compensatory measures had to be introduced. For the safe operation of the H4IRRAD facility in the H4 beam-line there is now an agreement in place to operate with beam intensities up to $3 \times 10^9$ particles per pulse, which is three times higher than last year. The repair of the TAX tables allows to switch to attenuated primary beam mode and to reach this intensity.

The COMPASS experiment has commissioned its apparatus and has started to take data for the Primakoff programme, which involves regular switching between hadron and muon beam operation.

The EHN1 beams have been operating smoothly and served a multitude of users,
in particular CALICE SDHCAL, ATLAS MMEGAS, CMS, CREAM and NA61
tests in the H2 beam-line, CMS-ECAL, H4IRRAD and RD51 in H4, MEDIPIX,
XSECT, ATLAS IBL, CERF and BELSVD-DEP in H6 and AIDA, TIMEPIX,
LHCB, ATLAS, CALICE WDHCAL, UA9 and TOTEM in the H8 beam.
The work for the NA62 experiment had to be slowed down significantly during
the TAX repairs, but has taken up at full speed again since mid May. The beam
line installation is well under way and most of the magnets are in place and the
collimators are being prepared. A copper TAX block delivered from a company
did not meet the specifications and had to be refused. New, forged, Copper
blocks have been ordered and their delivery is expected for the middle of
October 2012, just in time for installation before the first technical run of the
experiment. However an alternative scenario has been prepared for the technical
run in case the collimator for the beam line would not be ready in time.
All other preparations are on track for the technical run.
The AD started as planned on 27 April 2012 and achieved good beam quality
very quickly. Compared to last year the ejected beam emittance from the PS has
been improved, both transverse and longitudinal. An optics improvement
campaign is ongoing, taking advantage of the improved beam diagnostics (GEM
detectors) in the beam-lines. The goal is to optimise the transfer efficiency
mainly for the ASACUSA radio-frequency-quadrupole and also to gather more
precise optics understanding in view of the ELENA transfer line design.
During the week 18 June to 24 June 2012 the ACE run took place with excellent
uptime and beam quality.
The ASACUSA experiment profited from the ACE run and installed a new trap.
ATRAP are about to start their physics run, this year using both experimental
zones after only having used one for several years.
The ALPHA experiment will start up with a new version of their trap.
AEGIS has completed their first run and will now continue installation work.
The work on infrastructure of the AD hall is progressing and the first part of the
new user barracks installation is completed, including a covered entrance and
new access point to the hall.
For the CNGS facility the number of delivered protons is less than expected. In
addition to the reduction of delivered protons because of the bunched beam
measurement for the neutrino time-of-flight, there were several issues causing
this, the vacuum window at one end of the primary proton beam line, two
ventilation units cooling the first He-tube and parts of the reflector developed
problems which were repaired in situ or which will be fixed in the coming
technical stop of the accelerators end of June.
Also the number of protons sent onto the CNGS target (p.o.t.) per extraction is
limited to $1.5 \times 10^{13}$ p.o.t. (in 2011: $2 \times 10^{13}$ p.o.t.) because of radiation limits which
otherwise will be exceeded at a location close to the PS extraction into the SPS.
5. PS, SPS AND AD SCHEDULES

H. Breuker presented the changes in the 2012 PS, AD and SPS users schedules. The time for the fixed-target physics in 2012 was reduced by one week with respect to the schedule, which was presented at the 105th meeting of the SPSC and ends on 26 November 2012.

6. DISCUSSION OF THE OPEN SESSION

6.1 NA58 (COMPASS)

The SPSC congratulates the COMPASS collaboration for timely publication of new results on several aspects of the nucleon spin structure.

The SPSC acknowledges the progress in the analysis of the hadron beam data and is looking forward to publications in this subject area.

The SPSC notes with pleasure the successful start of the Primakov data taking and the progress on the experimental setup for the DVCS run, and is looking forward to results of the 2011 and 2012 data-taking periods.

6.2 CNGS1 (OPERA)

The SPSC congratulates the OPERA collaboration on the announcement of the second tau neutrino candidate event.

The Committee is looking forward to completion of the analysis of the 2010 and 2011 data and to the publication of the results.

The Committee acknowledges the effort and successful collaboration between CERN, LNGS, OPERA, ICARUS, LVD and Borexino to bring the neutrino time-of-flight measurement to a conclusion. The SPSC is looking forward to the publication of the final results.

6.3 CNGS2 (ICARUS)

The SPSC appreciates the smooth operation and efficient data collection by ICARUS and the contribution of the collaboration to the neutrino time-of-flight measurements. The committee acknowledges the progress in automated event filtering and reconstruction. The committee is looking forward
to first physics results.

6.4 DISCUSSION OF THE EXPRESSION OF INTEREST SPSC-E-007

The SPSC welcomes the received Expression of Interest for a very long baseline neutrino oscillation experiment (LBNO), SPSC-E-007. The Committee will further review the project.

6.5 DISCUSSION OF THE LETTER OF INTENT SPSC-I-241

The SPSC welcomes the Letter of Intent SPSC-I-241 to perform a measurement of the antiproton magnetic moment with a $10^{-9}$ precision in a two-stage approach. The committee recognises the physics motivation and the opportunity offered at the Antiproton Decelerator.

The SPSC invites the collaboration to submit a technical proposal. In view of the stringent stability requirements of the experiment, the Committee advises to optimise the insertion of the setup at the AD in close collaboration with the accelerator and experimental area experts and the other AD experiments.

7. FOLLOW-UP ON EXPERIMENTS AND PROPOSALS

7.1 DISCUSSION OF THE PROPOSAL SPSC-P-347

The SPSC acknowledges the progress and first feedback by the collaboration addressing the questions by the referees on technical and organisational issues of the proposed experiment. The Committee will continue reviewing the proposal including remaining open questions.

The committee recommends a joint effort between the collaboration and the CERN beams department to carry out the studies necessary to define the experimental setup and to assess the costs and possible schedule for a new neutrino beam line and the experimental infrastructure.
7.2 AD4 (ACE)

The Committee encourages the ACE collaboration to perform in 2012 the last measurements necessary to complete their programme. The SPSC asks the SPS and PS Coordinator to schedule a maximum of three days for these measurements and to minimise impact on other experiments.

8. DOCUMENTS RECEIVED

- Minutes of the 105th Meeting of the SPSC held on Tuesday and Wednesday, 3 and 4 April 2012
  CERN-SPSC-2012-016; SPSC-105 - 2012
- COMPASS Status Report 2012
  CERN-SPSC-2012-017; SPSC-SR-102 - 2012
- ICARUS report to the June 2012 meeting of SPS-C
  CERN-SPSC-2012-018; SPSC-SR-103 - 2012
- Direct High-Precision Measurement of the g-Factor of a Single Antiproton Stored in a Cryogenic Penning Trap
  CERN-SPSC-2012-019; SPSC-I-241 - 2012
- OPERA Status report (June 2012)
  CERN-SPSC-2012-020; SPSC-SR-104 - 2012
- Expression of Interest for a very long baseline neutrino oscillation experiment (LBNO)
  CERN-SPSC-2012-02; SPSC-EOI-007 - 2012.

CERN Document Server (CDS):
Memo: Impact of the LHC Long Shutdown 1 on the CERN FT Program
MEMORANDUM

To : R. Forty, Scientific Secretary CERN Research Board

Cc : R. Heuer, Director General
     S. Bertolucci, Director for Research & Computing
     P. Bloch, Head of PH Department
     S. Lettow, Director for the Administration & Infrastructures
     C. Vallee, SPSC Chairperson

From : S. Myers, Director for the Accelerator & Technologies
       F. Bordry, Head of TE Department and Project Leader for LS1
       P. Collier, Head of BE Department
       R. Saban, Head of EN Department

Subject : Impact of the LHC Long Shutdown 1 (LS1) on the CERN FT Program.
          The revised plan.

Following our previous memorandum dated September 21st, and the request of the FT Community to include a short run of the North Experimental Area in 2014, the proposal was reviewed. Also, requests to extend the present run were taken into account. The following draft program emerged:

<table>
<thead>
<tr>
<th>Facility</th>
<th>End of physics</th>
<th>Start of Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD</td>
<td>December 17, 2012</td>
<td>July 15, 2014</td>
</tr>
<tr>
<td>Isolde</td>
<td>December 17, 2012</td>
<td>June 15, 2014</td>
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<td>East Hall</td>
<td>December 17, 2012</td>
<td>July 15, 2014</td>
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<td>n_ToF</td>
<td>December 17, 2012</td>
<td>July 15, 2014</td>
</tr>
<tr>
<td>CNGS</td>
<td>December 3, 2012</td>
<td>-</td>
</tr>
<tr>
<td>North Area (protons)</td>
<td>December 3, 2012</td>
<td>October 15, 2014</td>
</tr>
<tr>
<td></td>
<td>February 11, 2013</td>
<td></td>
</tr>
<tr>
<td></td>
<td>March 1, 2015</td>
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</tr>
</tbody>
</table>
The removal of the irradiated cables in the LSS1 zone of the SPS will be completed on-time for the start up of the cold checkout of the SPS on June 27th 2014. Beam to the North Area is scheduled for October 15th 2014.

A winter shutdown of the FT facilities will take place from December 15th 2014 to March-May 2015. During this shutdown, the replacement and the relocation of the irradiated cables in the TDC2 of the North Area will be completed. Also, the installation of the new ventilation system split between the target area and the experimental hall for NA62 is envisaged during the same period. This will allow the experiment to run at nominal intensity for the remaining of 2015. In addition, in order to allow an ion run (NA61) in parallel with an LHC proton run in 2015, an additional interlock system requiring cables from LSS5 to BA3 and from LSS2 to BA3 will have to be installed.

The run of the AD in 2015 will have to be interrupted for five months for the removal of the kicker platform from the AD to the new building, which will not be ready before January 2015. The construction of Elena can start only after this removal.