OPEN SESSION – STATUS REPORTS

1. LHC Machine Status Report: F. Bordry
2. LHCf Status Report: Lorenzo Bonechi
3. CMS Status Report: Matteo Sani
4. TOTEM Status Report: Nicola Turini
5. ATLAS Status Report: Sarah Heim
6. ALICE Status Report: Federico Ronchetti
7. LHCb Status Report: Lucio Anderlini

CLOSED SESSION:


* part-time

Apologies: M. Demarteau

1. EXECUTIVE SUMMARY

General

2015 has been a successful year, with good luminosity delivered in proton-proton and lead-lead collision modes. Special runs and Van der Meer scans were performed as expected. The Year End Technical Stop (YETS) 2015/16 has been very successful. Beam commissioning will start on March 29th, with a slight delay of about one week. Several damaged components have been repaired. Although the origins of these damages are fairly well understood, the LHCC expresses the concern that operation in the cavern may, over the years, become more risky. It encourages the experiments and CERN to develop proper and updated documentation on the installed systems and on the conduct of operation, as well as introducing monitoring and sensing equipment apt to prevent damages.

Report from the LHC Programme Co-ordinator

The LHCC heard a report of the LHC Programme Co-ordinator on the plans for 2016 running of the LHC. The primary aim for the 2016 run is to deliver high luminosity 13
TeV collision data to the experiments. The machine configuration will be kept very similar as in 2015, to ensure a smooth start-up, although with reduced $\beta^*$ (likely 40cm in IP1/5) and associated changes in the crossing angle. The current schedule foresees 145 days of high intensity proton running, with a goal of delivering 25/fb to the high luminosity interaction points. A few days of running at very high $\beta^*$ (2.5km) has been requested by ALFA/TOTEM to allow access to the very interesting coulomb-nuclear interference region with the Roman Pots placed at 3$\sigma$ to the beam. The LHCC endorses this request but notes that this is challenging for the machine and will require dedicated studies and commissioning. At the December 2016 meeting the LHCC is planning to convene a discussion examining the long-term prospects for the forward physics programme, matching the machine special running conditions with the detectors readiness. A proposal has been developed for the programme of the four-week heavy-ion data-taking period scheduled in 2016, considering the requests of all experiments. The recommended scheme involves taking proton-lead data at 5.02 TeV and 8.16 TeV centre-of-mass energy, including one long fill at 8.16 TeV with low luminosity optimized for LHCf data taking. The LHCC endorses this scheme and encourages the experiments to provide a more quantitative physics case for the requested luminosity. A more in-depth examination of the heavy-ion programme will be convened by the LHCC to look at the overall physics goals and strategies over the next years. The initial step of this process will be a dedicated session at the May LHCC meeting, with the aim of concluding on the details of the 2016 heavy-ion run schedule.

Test Beams

The PS and SPS Physics Co-ordinator reported on the LHC test beams. He presented the latest version of the test beam schedule in the PS East Area and in the SPS North Area, stating that a few changes had been made to the schedule, mainly due to the cancellation of some periods by the respective users. He reported that lead ions will be extracted to the North Area for four weeks near the end of 2016, with the possibility of testbeams at the H4 and H8 beam lines. In addition eight weeks of xenon running are planned for 2017, and a further 4 weeks of lead running in 2018. The Co-ordinator further reported on the North Hall extension for the Neutrino Platform, which is making good progress, with beam line commissioning foreseen for next summer and first test beams for the LAr detectors expected in 2018. Several issues have been identified in the East and North area because of old equipment. The LHCC recognizes the need for consolidation of these areas that represents unique facilities indispensable for the CERN program and in particular for the Phase-II LHC detectors upgrades.

Report from the Upgrade Cost Group (UCG)

Experiments are progressing in preparing the TDRs for the Phase-II upgrades, and the LHCC/UCG is monitoring the progress closely. UCG recommendations are detailed in the reports submitted to the Research Board and listed below. The LHCC/UCG reminded the experiments to design to a scale of funding between the full funding and the intermediate scenario. TDRs should be submitted only when they are mature, and when risks are understood and at an acceptable level. The LHCC/UCG recommends that cost estimates for each subsystem be updated regularly, so that the overall cost of the project remains understood as TDRs are submitted. A fixed set of milestones should be produced for the preparation of each TDR, and then tracked throughout the project. The LHCC/UCG notes that since authoritative technical evaluations of the TDRs are essential, the LHCC and UCG will need to be augmented with additional expertise to accomplish this, possibly using also expertise from the LHC experiments.
ALICE
Excellent progress was reported on the ALICE physics analysis, with 11 papers published, five papers accepted for publication, and nine papers submitted for publication since the last meeting, bringing the total to 148 publications. After successfully taking proton-proton collision data earlier in the year, ALICE experienced excellent LHC availability during the heavy-ion run, with an average luminosity levelling time of 2.46 hours. During the YETS an upgrade of the read-out control units (RCU2) was installed, which are now fully functional, allowing for faster readout. During high interaction rate runs large hit distortions were observed in some areas of the TPC, leading to a reduction of the track matching efficiency. A procedure was developed to correct these distortions and is working well, however the cause of the distortions is not fully understood. The LHCC recommends that the collaboration make every effort to understand and correct the cause of these distortions, also considering possible implications for the TPC upgrade. The foreseen complete gas exchange may help to understand the issue. The LHCC heard that the upgrade of the read-out and trigger electronics is progressing well and within the schedule. In the design of the upgraded TPC readout architecture, the baseline correction has been moved to the common read-out unit (CRU), which has been found to be more robust and flexible than performing it in the SAMPA read-out chip. This implies streaming all raw data to the CRU, requiring extra fibres, and hence significant additional cost, in case the full 10 MHz ADC sampling rate is used, while no additional fibres would be needed for a 5 MHz sampling. The LHCC invites the collaboration to review the options internally and present them to the LHCC for discussion. The LHCC notes the increased effort on the SAMPA development, which remains on the critical path. The production of GEM foils for the TPC read-out chambers in the CERN workshop has recently suffered from inhomogeneities in the raw material, which are being addressed with the supplier. The LHCC notes that this issue should be monitored closely.

ATLAS
ATLAS analysis is progressing well, with 513 scientific papers submitted to date, including 25 since the previous LHCC session. ATLAS has completed the 2015 heavy-ion run with a total of 0.67/nb recorded. The work plan for the YETS is progressing well and nearing completion with the detector expected to be ready for beam well before the end of March. The rise of the current in the Inner B-Layer (IBL) read-out electronics has been studied further in the laboratory and has been confirmed to improve with higher radiation levels, with the peak current depending on the operating temperature. The operational strategy for 2016 and beyond will be defined after more tests have been carried out. The temperature-related geometry distortions are being tracked by the alignment system. The running strategy of the Transition Radiation Tracker (TRT) has been evaluated in the light of the current leak situation. A larger part of the detector will be operated with Argon, as the overall compromise on the quality of the particle identification has been found to be small, leading to cost savings and a more stable configuration. The LHCC took note of a jump in gas leaks in the RPC chambers, likely due to a pressure surge when turning on the gas system. An improved procedure will be developed to avoid this problem in the future, and as many as possible of the new leaks will be repaired. The bellows distortion in the End-Cap Toroid (ECT) magnet reported at the previous LHCC has been addressed by the installation of a protective over-bellows. A dimple has been found in a bellows of a beampipe transition. Although no related leak has been detected, the bellows will be secured with a clamp before the detector is closed for beam operations. The LHCC heard that one arm of the ATLAS Forward Proton
detector has been installed, with cabling and services already installed for both arms. The next arm will be installed in the next YETS. An in-depth review of the Phase-I upgrade projects was carried out. The trigger and DAQ (TDAQ) upgrade is progressing well. The AM06 read-out chip of the ATLAS Fast Tracker (FTK) is now in production. The current schedule foresees to cover the barrel region of the detector with FTK capability during the summer of 2016, with full coverage reached by spring 2017. The Level-1 Calorimeter Trigger Upgrade has encountered issues with the two types of ASICs employed in the system, leading to concerns for the schedule. Although there is still a reasonable contingency at this time, the LHCC encourages ATLAS to proceed with the developed backup plan if the original design does not guarantee enough technical and schedule safety. The upgrade for the muon New Small Wheel (NSW) is making good progress for the mechanics, engineering and alignment systems, however, several problems have been encountered in the production of both chamber types, leading to a very critical schedule for installation in LS2 with no contingency at this point. The LHCC encourages the ATLAS management in getting the project on track in particular through a mobilization of the muon community, and by working out time contingency scenarios in case of non-recoverable schedule delays. Good progress was reported on the Phase-II upgrades, with 6 TDRs planned for the period from December 2016 to December 2017.

**CMS**

The CMS collaboration has published or submitted for publication 464 scientific papers. Many shutdown activities have been successfully completed. The operation of the CMS magnet has been problematic during 2015, with clogging of the cryogenics filter system requiring regular interventions. The source of the contamination has been identified and comprehensively addressed by a complete cleaning of the cooling system and an upgrade of the oil filters and coalescers. The LHCC notes that slight delays in the installation of parts have significantly reduced the time available for CMS commissioning with magnetic field prior to physics. Plans to assure long term, safe operation of the magnet have been developed, also through a dedicated expert review carried out in December 2015. Just before the end of the 2015 heavy-ion run, a substantial water leak developed in the cooling pipes of one muon chamber. During the YETS the leak was located and fixed, and water damage was addressed. Mitigation measures have been put in place to limit the impact of further faults of this type. The LHCC notes that a more detailed plan for the longer term will be developed to address this issue in future shutdowns. A report on the Phase-I upgrades was given. The LHCC heard that the Phase-I upgrades for the Trigger system have already been completed and will be used in the 2016 running. The upgrade of the HCAL electronics is complete for the back-end electronics, however significant delays in the production of the front-end electronics put this project on the critical path for installation in the EYETS 2016/17. The upgrade of the CMS Pixel detector, also foreseen for the EYETS 2016/17, is making steady progress, although delays in module assembly and the production of the read-out chip lead to a critical schedule. The LHCC recommends the management to closely follow the development of these projects. A decision is expected by the next LHCC on what can be installed in the upcoming shutdown. For Phase-II, good progress was reported since the previous meeting of the LHCC in all areas. Emphasis is on technical developments in preparation for the TDRs, with the first one (Tracker) expected in mid-2017.

**LHCb**

The physics analysis programme of LHCb is progressing well, with 301 scientific publications submitted so far. LHCb completed a successful run in 2015, including the
first collection of lead-lead and lead-argon collisions. The LHCC encourages LHCb to present a detailed physics programme for the heavy-ion runs to optimise the usage of the available beams. The LHCb sub-detectors are working well and required only minor interventions during the current YETS, which have all been successfully completed. The experiment is ready for data taking and will start extended cosmic data runs in early March in preparation for beam re-commissioning. The Phase-I upgrades are progressing well, with significant advances reported on the Upstream Tracker (UT), Vertex Locator (VELO), Scintillating Fibre Tracker, and Ring Imaging Cherenkov (RICH) detector. The submission of the VELOPIX chip has been delayed, with a new submission date no later than April. The delay can be absorbed in the schedule. The RICH schedule has been updated to account for design changes due to radiation tolerance issues with several of the employed electronics components. The LHCC notes that these delays should be monitored carefully, however the current schedule is still compatible with the planned installation in LS2. The upgrade of the LHCb online system is progressing well, with two milestones recently reached ahead of schedule.

LHCf

The data analysis of the 2015 proton-proton data is making steady progress following the detector calibration campaign completed at the SPS. LHCf has submitted a letter of intent for a proton-lead run at 8 TeV in 2016, with the intention to collect in excess of 40000 neutral pion events triggered in conjunction with ATLAS. The proposal is compatible with the machine running conditions during the heavy-ion period. The LHCC endorses the proposal and will monitor its progress closely.

TOTEM

The TOTEM collaboration reported on the status of the joint CMS-TOTEM analysis of 2015 special run data at $\beta^* = 90$m, which is making good progress. In relation to the change of the beampipe in LS2 the LHCC heard that TOTEM does not intend to re-install the current T2 detector after LS2, but considers it essential to maintain the possibility to have a T2-like detector for large rapidity coverage. The LHCC encourages TOTEM to produce as soon as possible a written proposal outlining the physics goals for such a detector, and discuss the implications with CMS, such that they can be taken into account in the on-going design of the LS2 beam pipe replacements. To search for a possible 750 GeV $\gamma\gamma$ resonance, the schedule of the CMS-TOTEM Proton Precision Spectrometer (CT-PPS) has been anticipated to start as soon as possible using available TOTEM tracking and timing sensors, with continued R&D of other technological options and replacements foreseen in technical stops as they become available. The LHCC notes that this change puts the project on the critical path. The LHCC recommends that a complete schedule is made available to the committee to help monitor the progress of the project. The LHCC encourages CT-PPS to work with the machine experts to find suitable running conditions that enable the proposed physics programme without impacting the high-luminosity data taking.

WLCG

The WLCG and the experiments continue to make excellent use of the available resources, which matched the requirements for the 2015 running also thanks to many improvements made in execution speed of jobs and storage management. Pledges and resources are in place for 2016/17. The computing needs for the Phase-I and Phase-II upgrades are being actively studied. The computing requirements for HL-LHC were discussed at the WLCG workshop in February. A study group has been set up to establish
and update the computing requirements for HL-LHC and to consider the long-term evolution of computing models and large-scale infrastructures. The LHCC will continue to follow on-going developments. The LHCC notes that software tools and expertise remain a crucial ingredient in further improving the use of computing resources and to enable the next stages of computing upgrades.

2. **PROCEDURE**

The Chairman welcomed the new members of the LHCC, A. Kuzmin and T. Wengler (Scientific Secretary), as well as the new ex-officio members F. Gianotti (CERN, Director General), E. Elsen (CERN, Director for Research and Computing), M. Krammer (CERN, EP Department Head), J. Boyd (CERN, LHC Programme Co-ordinator) and C. Schwick (CERN, deputy LHC Programme Co-ordinator). The minutes of the one-hundredth-and-twenty-fourth LHCC meeting (LHCC-2015-025 / LHCC-124) were approved.

3. **REPORT FROM THE DIRECTOR FOR RESEARCH AND COMPUTING**

The Director for Research and Computing reported on issues related to the LHC. For the computing the way forward is well defined for the next years, however for the longer term the funding model is not yet settled. Activities around the Science Computing Cloud are an interesting development that CERN follows actively, and may be a model for the Funding Agencies to manage the needed increase in investment in the computing area. For the upcoming run of the LHC 25 fb⁻¹ of collision data are expected. After many successful interventions during the YETS, all experiments are ready for data taking.

4. **REPORT FROM THE LHC PROGRAMME CO-ORDINATOR**

The LHCC heard a report of the LHC Programme Co-ordinator on the plans for 2016 running of the LHC. The primary aim for the 2016 run is to deliver high luminosity 13 TeV collision data to the experiments. The machine configuration will be kept very similar as in 2015, to ensure a smooth start-up, although with reduced $\beta^*$ (likely 40cm in IP1/5) and associated changes in the crossing angle. The current schedule foresees 145 days of high intensity proton running, with a goal of delivering 25/fb to the high luminosity interaction points. A few days of running at very high $\beta^*$ (2.5km) has been requested by ALFA/TOTEM to allow access to the very interesting coulomb-nuclear interference region with the Roman Pots placed at 3σ to the beam. The LHCC endorses this request but notes that this is challenging for the machine and will require dedicated studies and commissioning. At the December 2016 meeting the LHCC is planning to convene a discussion examining the long-term prospects for the forward physics programme, matching the machine special running conditions with the detectors readiness. A proposal has been developed for the programme of the four-week heavy-ion data-taking period scheduled in 2016, considering the requests of all experiments. The recommended scheme involves taking proton-lead data at 5.02 TeV and 8.16 TeV centre-of-mass energy, including one long fill at 8.16 TeV with low luminosity optimized for LHCf data taking. The LHCC endorses this scheme and encourages the experiments to provide a more quantitative physics case for the requested luminosity. A more in-depth examination of the heavy-ion programme will be convened by the LHCC to look at the overall physics goals and strategies over the next years. The initial step of this
process will be a dedicated session at the May LHCC meeting, with the aim of concluding on the details of the 2016 heavy-ion run schedule.

5. **REPORT FROM THE UPGRADE COST GROUP (UCG)**

The LHCC heard a report from the Upgrade Cost Group (UCG). Experiments are progressing in preparing the TDRs for the Phase-II upgrades, and the LHCC/UCG is monitoring the progress closely. UCG recommendations are detailed in the reports submitted to the Research Board and listed below. The LHCC/UCG reminded the experiments to design to a scale of funding between the full funding and the intermediate scenario. TDRs should be submitted only when they are mature, and when risks are understood and at an acceptable level. The LHCC/UCG recommends that cost estimates for each subsystem be updated regularly, so that the overall cost of the project remains understood as TDRs are submitted. A fixed set of milestones should be produced for the preparation of each TDR, and then tracked throughout the project. The LHCC/UCG notes that since authoritative technical evaluations of the TDRs are essential, the LHCC and UCG will need to be augmented with additional expertise to accomplish this, possibly using also expertise from the LHC experiments.

6. **REPORT AND DISCUSSION WITH THE LCG REFEREES**

The LHCC congratulates the experiments and the WLCG for successful computing operations and prompt delivery of the resources for data processing and analysis.

The YETS has been used efficiently by all experiments to perform the remaining data processing, prepare the future Monte Carlo productions and the software for 2016, while at the same time continuing the intense analysis work. The resources have been used efficiently. The preparation the requests for future pledges has progressed smoothly. The computing needs have only been marginally adjusted for 2017, and are being discussed with the CRSG.

There is an increasing interest in the experiments in the medium-to-long term computing conditions. A recent WLCG workshop was used to structure the long term planning in several directions. These include the definition of the upgrade problem, software-related activities, performance evaluation, and prototyping. It was agreed to update the document on computing models and software evolutions regularly (next update is planned by the end of the year). This fits well with the LHCC proposal to prepare the ground for a quantitative discussion on the computing needs for upgrade Phase-II, a discussion that is expected to start by the end of the year.

Several ideas for medium/long term computing improvements are now structured either as common projects (GAUDI hive) or as concrete contributions to the working groups defined as a part of the HEP Software Foundations HSF. The LHCC encourages such initiatives and recommends that an allocation of dedicated person power be considered by the funding agencies and laboratories. This must however not disturb the ongoing activities in the experiments, which are very intense at any given time.

In this context, a generic worry about the absence of software developers has to be mentioned. The success of these very ambitious projects relies not only on dedicated software engineers, the amount of which is considered to be in general insufficient within the LHC experiments, but also on voluntary contributions from the collaborators. The potential of the latter contribution is diminished by the lack of career prospects for the
physicists working in software and computing. The committee acknowledges that the community has taken steps towards a better understanding of the career patterns via a dedicated forum, and encourages the LHC computing community to proceed to a sustained communication in this area. Quantitative arguments (like a person power mapping, surveys, prospective brainstorming etc.) would be very useful to document and discuss with the funding agencies in the future.

7. DISCUSSION WITH LHCf
The LHCf analysis of photons in the very forward region with 13 nb⁻¹ of p-p collisions at 13 TeV is being finalized. The Monte Carlo production for the comparison with different physics generators is 90% complete and the preliminary results on the photon spectra at \( \eta > 8.8 \) have been presented. The study of systematics is in progress, with the contribution from the absolute energy scale reduced to the 3.5% level after the calorimeter calibration at the SPS, in August 2015. An intense work programme was carried out to finalize the Letter-of-Intent (LoI) for a p-Pb run at 8.16 TeV. LHCf recorded data from p-Pb collisions at 5 TeV in 2013 and studied the inclusive \( \pi^0 \) production on the basis of an integrated luminosity of 0.63 nb⁻¹. The proposed run at 8 TeV, aiming to select more than 40000 neutral pion events triggered in conjunction with ATLAS, could extend the study both in energy, from a laboratory-frame energy of \( 1.4 \times 10^{16} \text{ eV} \) to \( 3.6 \times 10^{16} \text{ eV} \), and in statistical accuracy. Moreover, better separation power among interaction models is expected by the increase of events in the high-\( p_T \) region, and more precise subtraction of the background from Ultra Peripheral Collisions (UPC) could be achieved by the measurement of particle multiplicities in ATLAS. In addition the measurement of the inclusive production of \( \eta \) mesons could be obtained in addition to photons, neutrons and \( \pi^0 \)'s. The proposed run would last from 12-24 hours, depending on the maximal exchanged trigger rate (100-400 Hz) in conjunction with ATLAS. The details of the detector installation have been discussed with the CERN radio-protection group. The LHCf run does not require any change in the machine optics, but a dedicated long fill at a lower luminosity of \( 10^{38} \text{ cm}^{-2} \text{ s}^{-1} \), with inter-bunch spacing not shorter than 100-150 ns. The LHCC endorses the proposal and recommends to include in the heavy-ion program one long fill at 8.16 TeV optimized for LHCf.

8. TEST BEAMS
The PS and SPS Physics Co-ordinator reported on the LHC test beams. He presented the latest version of the test beam schedule in the PS East Area and in the SPS North Area, stating that a few changes had been made to the schedule, mainly due to the cancellation of some periods by the respective users. He reported that lead ions will be extracted to the North Area for four weeks near the end of 2016, with the possibility of testbeams at the H4 and H8 beam lines. In addition eight weeks of xenon running are planned for 2017, and a further 4 weeks of lead running in 2018. The Co-ordinator further reported on the North Hall extension for the Neutrino Platform, which is making good progress, with beam line commissioning foreseen for next summer and first test beams for the LAr detectors expected in 2018. Several issues have been identified in the East and North area because of old equipment. The LHCC recognizes the need for consolidation of these areas that represents unique facilities indispensable for the CERN program and in particular for the Phase-II LHC detectors upgrades.
9. DISCUSSION WITH CMS

Data Analysis

The total number of papers submitted by CMS is 464 with an additional 38 ready for internal review. Three papers were published and another three submitted based on Run 2 data. About 150 papers are expected in spring-summer of 2016 with a large fraction of them on 13 TeV data. This is a clear indication of the success of CMS with data collection and analysis at the new energy frontier.

Highlights of the 13 TeV results include di-boson (WW and ZZ), top pairs and single top quark production cross section measurements, which are all in agreement with the Standard Model predictions. The 2.9 TeV effective mass di-electron event, observed early in Run 2, remains a single event in this mass range and with 3 fb\(^{-1}\) integrated luminosity is in agreement with the Standard Model predictions. The “750 GeV” excess in the di-photon mass spectrum for CMS has a global significance of ~1.2 sigma. With ~10 fb\(^{-1}\) of 13 TeV data expected by summer 2016 this excess will most probably be confirmed or disproved by both CMS and ATLAS.

CMS reconstruction and data analysis infrastructure are ready for the new data analysis starting in early May 2016 with a large number of new results expected for the ICHEP conference in August.

CMS Activities During 2015-2016 End of the Year Technical Stop

The main goal during this shutdown was to repair the CMS solenoid cooling system. The well-planned activities progressed on schedule; with the magnet cooling system cleaned using a special solvent under high pressure. A substantial amount of oil was extracted from the solvent confirming expectations that the cooling system issues were related to the contamination with oil from the helium compressors. Compressor hall oil filters and coalescers have been replaced to prevent future issues with oil getting into the cooling system. The magnet is expected to be cold and at full field in time for the LHC physics collisions in early May 2016.

Many other maintenance and repair activities have been accomplished safely by CMS and CERN during this technical stop. They include repairs of a 6,000 liters dewar on the top of the detector damaged before Run 2 and fixing the water leak in the endcap muon chamber.

Preparations for the 2016 Run

From February 2016 CMS mid-week global runs started to commission all systems for data taking. From early April 24/7 shifts started and will last through the 2016 run.

The tracker had no major interventions during YETS. Electromagnetic calorimeter refurbishment of low voltage power supplies and low voltage connectors were performed, with calibrations optimized for 2015 data and ready to proceed with the calibration with 2016 data when they appear. The hadron calorimeter had several maintenance tasks performed and demonstrated partial recovery of the radiation damage between December 2015 and February 2016 (~5%) in the end portion of the calorimeter. In the muon system a water leak was fixed and the replacement of the drift tubes trigger electronics completed. All detectors are ready for the commissioning with beam and data collection at 13 TeV.
Part of the HLT farm was replaced with modern CPUs, increasing the computing power by a factor of 1.4. CMS plans to start the 2016 run with the full Phase-I trigger upgrade accomplished. The upgraded trigger system was validated during the 2015 run by running “old” and “new” trigger systems and comparing results, which are in good agreement. Level 1 and HLT trigger menus were developed to cover various LHC running conditions up to a luminosity of $1.3 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$.

The software release to be used for data processing and Monte Carlo production (CMSSW 8.X) will be validated by the second half of March, starting event simulation for ICHEP by April 1st with the aim to get $\sim 5B$ events by early June.

**Phase-I Upgrades**

Calorimeter and pixels upgrades experienced delays. For the HF calorimeter front-end system upgrade the majority of the boards are ready, except 144 QIE cards. Errors were observed in the QIE10 ASIC (range transistor errors). They will be fixed in the next chip submission. The plan is to have re-worked boards at CERN in June/July in time for installation during 2016-2017 YETS.

The HE calorimeter front-end upgrade was originally planned to be installed during LS2, but due to HE light yield degradation CMS decided to speed up installation to 2016-2017 YETS. Two areas of concerns were identified: QIE card components are delayed, including QIE11 ASIC and SiPM bias/control, and mounting cards are behind schedule. This project is on the critical path for early installation. Around June 2016 the decision will have to be made when to install.

The barrel pixels ROC chip for layer 1 is not yet ready with prototypes still under tests. CMS expects to submit the final production batch in March with chips to be available for assembly in July. This will enable layer 1 modules production to start early July with completion in about two months. This project is on the critical path. Backup solution is to use the ROC chip available for layers 2-4 and foresee a replacement of the first layer during LS2. Benefits and drawbacks of such solution, if it will be required, should be discussed at the next LHCC meeting.

Forward pixels module assembly was halted late January due to low yield, which appeared to be related to damage in the readout chips (vendor changed assembly procedure). A solution was developed and the recent yield of good modules of 85% is in line with what is required to produce enough modules within the current schedule. Mechanics assembly is progressing on schedule while cooling lines assembly halted due to cracks discovered in the welds. The current plan is to finish the forward pixels modules production by early August.

Delays in the CMS pixels modules assembly and the production of the read-out chip lead to a critical schedule for the installation as planned during 2016-2017 extended YETS. The LHCC recommends the management to closely follow the development of this project to assure a fully tested and functioning pixels detector could be installed as planned. A decision is expected by the next LHCC meeting on what can be installed in the upcoming shutdown, including detailed testing, installation and commissioning schedules.

**Phase-II Upgrades**

Substantial progress has been achieved in all areas of the upgrade, including tracker design, forward calorimeter, muon upgrade and development of the simulation. Main
medium term goal is to finalize remaining technical choices in time for the TDRs, which are expected to be delivered to the LHCC during 2017.

10. DISCUSSION WITH TOTEM

During the December LHCC meeting the issue was raised of the compatibility between the continued operation of the T2 telescope and the plans by CMS for the replacement of the existing beam pipe, during LS2. TOTEM has now clarified that they do not intend to re-install the current T2 detector after LS2, but they consider it essential to maintain the possibility to have a T2-like detector for large rapidity coverage during Run 3. The LHCC encourages TOTEM to produce as soon as possible a written proposal outlining the physics goals for such a detector, and discuss the implications with CMS, such that they can be taken into account in the on-going design of the LS2 beam pipe replacements.

To search for the photoproduction of a possible 750 GeV $\gamma\gamma$ resonance in exclusive $p-p\gamma\gamma$ final states, the planning and schedule of the CMS-TOTEM Proton Precision Spectrometer (CT-PPS) have been modified. The goal is to anticipate data taking as soon as possible, by adapting to the CT-PPS pots the TOTEM silicon strip detectors and the timing diamond detectors that are part of TOTEM’s vertical timing upgrade project. The R&D and/or construction of the technologies and components initially planned for CT-PPS would meanwhile continue, with replacements foreseen in technical stops as they become available. The available silicon strip detectors could withstand an integrated luminosity of $O(10)$ $fb^{-1}$, and the available stock would allow for replacements through to the end of the 2016 run. The installation of two of the diamond timing detectors in one of the cylindrical horizontal roman pots, while not strictly needed for the measurement of a possible 750 GeV $\gamma\gamma$ resonance, would allow their qualification in the low-$\beta^*$ beam environment and facilitate the commissioning of the vertical timing roman pots for a possible run with $\beta^*$=90m in 2017. The LHCC believes that this change in the planning is justified by the interesting physics goal. The LHCC also notes that, while most of the needed actions have started in earnest, the new plan puts the project on the critical path. The LHCC recommends that a complete schedule is made available to the committee to help monitor the progress of the project. The CT-PPS project should also update the discussion of the physics programme, to document the impact that these changes will have on the initial goals presented in the TDR. In particular, in view of the apparent mismatch between the beam dispersion parameters assumed in the CT-PPS simulations and those which the LHC expects to deliver, the LHCC encourages CT-PPS to work with the machine experts to find suitable running conditions that enable the proposed physics programme, without impacting the high-luminosity data taking.

TOTEM has requested a special run, with $\beta^* \sim 2.5km$, to maximize the sensitivity of the elastic-scattering measurement to the Coulomb-nuclear interference region, reducing to $\pm 0.01$ the uncertainty in the measurement of the $\rho$ parameter. While extremely challenging from the accelerator perspective, the request has been discussed within the LPC and a slot of 3 days for running, plus one for beam setup, has been included in the LHC schedule for 2016. The LHCC confirms its support for the physics case, and endorses this request. As in the past, the LHCC recommends that maximum synergy be found between the needs and goals of TOTEM’s total and elastic cross section programme, and those of ATLAS’s ALFA detector.

The TOTEM collaboration reported on the status of the joint CMS-TOTEM analysis of 2015 special run data at $\beta^*=90m$, which is making good progress. The committee looks
forward to the completion and public release of these important analyses, which, among other things, could shed new light on the identification of glueball candidates.

11. DISCUSSION WITH LHCb

LHCb has had a very successful 2015 and YETS. Among the achievements are the first Pb-Pb and Pb-Ar collisions, training of a crew of new expert shifters, and the commissioning of many new developments. The overall detector efficiency was 90%. All LHCb subdetectors are in good shape. During the YETS several minor interventions were performed successfully. Activities included the installation of a new gas system, consolidation of the CV system and commissioning of the new control room. The LHCC appreciates the efforts put into the online calibration, improvements on alignment and track reconstruction, optimization of the HLT trigger, new monitoring software and new features in the turbo streams to maximize the physics output. The LHCC agrees that the LHCb detector is in excellent condition for the upcoming 2016 run.

The LHCb collaboration continues to have an excellent scientific output. They submitted their 300th paper a few days before the LHCC meeting. The total number of paper submissions is 55 for 2015 and nine for 2016, bringing the total to 301 publications. Thirteen papers and two conference reports were in the pipeline for the Winter conferences. Among the physics highlights are the first observation of $D^0$-$\bar{D}^0$ oscillations in $D^0 \rightarrow K \pi^+ \pi^- \pi^+$, a new measurement of $A_{CP}(D^0 \rightarrow K^+K^-)-A_{CP}(D^0 \rightarrow \pi^+\pi^-)$, the first observation of $\Lambda_b \rightarrow \Lambda K^+\pi^-$ and a study of $\psi(2S)$ production in p-Pb and Pb-p collisions, showing that $\psi(2S)$ production is significantly suppressed with respect to $J/\psi$ production. The LHCC commends LHCb for their diversified and interesting physics program.

For the upgrades significant advances were reported in several areas. Much activity is ongoing on the Upstream Tracker (UT). For sensor type A, the FanUp solution was chosen as the baseline since no efficiency loss was found near the top end of the sensor. For sensor type D, no efficiency loss is seen near the cutout. For both sensor types, the S/N remains high after irradiation with $0.3 \times 10^{14}$ n_{eq}/cm$^2$. The SALT-8 prototype tests show encouraging progress with full test setups available at CERN and Syracuse. The SALT-8v2 was submitted at the end of 2015. The SALT128 went through a review on Monday during the LHCC week. An engineering run is planned for the end of 2016 and production is expected for Q2 2017. Furthermore, progress was made with connecting the FLEX cables to the readout electronics. The LHCC acknowledges that the UT upgrade is progressing very well.

Work on the VELO upgrade is continuing. The VELOPIX submission was delayed. Though no major issues exits, it is a complex chip requiring many details to be worked out and time-consuming simulations to be performed. Submission will start no later than end of April to produce a fully functional chip. A detailed plan for reabsorbing the delay is in place. A lot of activity has been on microchannel cooling. One crucial piece is the cooling connector. A pressure test with a stiffener on the back was completed successfully. In addition, creep tests were performed at elevated temperature and pressure. While one slit was fine after 150 h, the other slit broke after 54 h. It was found that the creep developed at a void place. Hence care must be taken with the soldering procedure. Other tests involved the safety system and feed-throughs. The LHCC acknowledges that the VELO upgrade is a complex enterprise and that present delays
can be compensated in the overall schedule. Nevertheless, the timeline is tight. Thus, the LHCC will closely monitor the progress on the VELO upgrade.

Progress has also been reported on the SciFi tracker. The contract for fiber procurement was signed to deliver 11,000 km fiber in 100 weeks. Preparation for fiber mats and modules are well advanced. All production places received winding machines. A PRR for mat production at each production site is scheduled for April-June 2016. The PRR for module production is planned for summer 2016. A new bump removal concept was successfully tested by cutting and splicing the fiber on the winding machine. Six-layer mats remains the baseline, though eight-layer mats were tested successfully. New SiPMs with trenches were tested that have better geometrical matching to the fiber-mats. The cross-talk is reduced to 5% and the photon detection efficiency is increased to 50%. However, unexpected large delayed cross-talk and after-pulsing was observed that needs to be resolved. These effects are mitigated at lower overvoltage. For the cold box, successful mounting and thermal tests were conducted. The LHCC commends LHCb for their progress on the SciFi.

The RICH schedule was revised after the December LHCC meeting due to radiation hardness issues with the CLARO chip and the digital board. Since the mechanical design is complicated due to very tight space and the necessity for easy maintenance during running conditions, extra time is helpful. The RICH group had not yet updated their milestones to synchronize with the one-year delay in the start of Run 3. This extra time was used to revise the milestone schedule, shifting six milestones to June 2016 (EDR of digital board) and July 2016 (PRR of CLARO and digital board, PRR of elementary cell, EDR of photon detector module, EDR of RICH1 mechanics, EDR of RICH2 mechanics). The LHCC agrees that the revision of milestones presently causes no concern. However, the progress on the RICH upgrade and achieved milestones needs to be monitored closely.

In this LHCC meeting, progress on the online system was part of the upgrade review. In Run 3, the hardware trigger will be removed. Therefore, the filter farm has to process a larger event size and larger event rate, posing new challenges for the data acquisition and high-level trigger. The data will be transferred from the frontend electronics to the surface by 10000 optical links. The use of long-distance fibers was successfully validated in 2015 ahead of schedule. For the full system, the error rate will be less than five errors per day. The experimental and fast control systems are well advanced.

The readout board (second generation) is in excellent shape. Preproduction will be launched by the end of Q2 and the tender will be placed in the second half of 2016. The software development is progressing well. The milestone of event building to 600 nodes (Q2 2016), the settling on the final option for the data center (Q3 2017), a full DAQ network test (Q4 2017), the network technology decision (Q3 2018) and the start of commissioning (Q3 2019). The LHCC acknowledges that the upgrade of the online system is progressing very well.

The achieved milestone schedule is slightly trailing behind the expected milestone schedule. Since the LHCC meeting in December, four milestones were reached, one for the UT (cooling EDR), one for the muon system (prototype submission) and two for the online system. On the other hand, five milestones for the RICH were shifted to June/July 2016 and one milestone for the VELO was shifted to April 2016. The LHCC is confident that the delays can be compensated for in the overall schedule, however the milestone schedule needs to be monitored closely.
12. DISCUSSION WITH ATLAS

ATLAS successfully completed the 2015 heavy-ion run and recorded 0.67 nb-1 of data. The Collaboration has submitted 513 scientific papers so far, including 25 since the previous LHCC session in December 2015. The 13 TeV p-p data were processed extremely efficiently, and 28 new preliminary results were presented at the December End of Year Event. Eight papers on Run 2 data have already been submitted for publication, and about 50 papers and notes are being prepared for the winter conferences. An additional roughly 50 papers, summarising Run 1 benchmark Standard Model measurements, are in preparation.

The YETS work has progressed well and ATLAS expects to be ready for beam by around 22/3/16. Points worthy of note include:

- The bellows distortion in the End-Cap Toroid magnet has been ameliorated by encasing the distorted bellows with new permanent outer bellows to provide the necessary vacuum seal. The magnet should be at full field by week 14.
- The origin of the increase in dew point in the service region just outside the inner detector tracking systems was found to be due to a cable pressing on a valve; this has been fixed.
- An air leak into a TileCal cooling tube was found and fixed. As a result of access work all TileCal modules are now operational.
- During access work a bellows on Side C was dimpled; a collar has been installed to preserve the vacuum seal.
- A hybrid running configuration of Xenon/Argon in the TRT will be implemented for 2016; this will minimise Xe leaks with only a minor compromise of the electron-identification performance.
- The increase in current in the Inner B-Layer (IBL) read-out electronics has been studied further via laboratory tests. A suitable operating temperature will be chosen. Any geometry distortions will be tracked by the alignment procedure on a stave-by-stave basis for batches of luminosity within each beam fill.
- One complete AFP arm was installed and instrumented, and trigger cables and services for the second arm were also installed.

The Trigger/DAQ system is working well. A fixed-frequency limit has been applied to the trigger to prevent the IBL wire bonds resonating at the LHC beam circulation frequency. The main impact is that the Level-1 trigger rate is constrained at fill ramp-up.

The offline systems are working well. The 2016 reconstruction release has been validated and deployed; generation of the 2016 Monte Carlo sample is about to be launched. The 2015 heavy-ion data will be reprocessed with this release.

There was an in-depth referee review of the Phase-I upgrade projects. All projects are progressing, although numerous milestone delays have been incurred.

- The Fast TracKer (FTK) AM06 read-out chip is now in production; the AM Board is about to undergo Production Readiness Review (PRR). The schedule calls for 32 boards for full-eta coverage by April 2017.
- Both the LAr Calorimeter upgrade ADC and serialiser chips are delayed due to problems. The foundry has not so far delivered working serialiser chips and a backup solution is being vigorously pursued. The schedule for full delivery is tight and only modest contingency remains.
- The Level-1 Trigger/DAQ upgrade is progressing. The milestones have been
rebaselined and delivery of all components is now scheduled for the end of Q3 2018.

- Progress with the muon New Small Wheel (NSW) upgrade is significantly delayed. There have been problems with production of both the Micromegas and small strip Thin Gap Chamber (STGC) detectors. Corrective action has been taken but there is almost no remaining contingency if the NSW is to be installed in LS2.

The LHCC expressed concern about the slippage in schedule of the Phase-I upgrade projects, in particular the NSW.

Six TDRs are expected to be delivered for the Phase-II upgrade projects between December 2016 and December 2017. A discussion was held with the UCG and ATLAS on the procedures for the LHCC and UCG reviews of the TDRs.

13. DISCUSSION WITH ALICE

Physics

Since the LHCC meeting in December 2015, 11 ALICE papers have been published and 5 have been accepted for publication by journals. A further 9 new papers have been submitted. This brings the total number of ALICE papers to 148. New results focus especially on Pb-Pb collisions at 5 TeV, where the charged particle density at mid-rapidity in the 5% most central collisions was measured to be dN_{ch}/dη = 1943±54. A rise in dN_{ch}/dη as a function of √s for the most central collisions is observed, steeper than that observed in p-p collisions and following the trend established by measurements at lower energy. ALICE also reported on the first results of elliptic (v₂), triangular (v₃) and quadrangular flow (v₄) of charged particles in Pb-Pb collisions at 5 TeV. Compared to results from Pb-Pb collisions at 2.76 TeV, the anisotropic flow coefficients are found to increase by (3.0±0.6)% for v₂, (4.3±1.4)% for v₃ and (10.2±3.8)% for v₄, respectively, in the centrality range 0-50%. The measurements are found to be compatible with relativistic hydrodynamic model calculations further establishing the validity of the hydrodynamic picture.

Operation

During the 13 TeV p-p data taking period ALICE recorded a total of 600M minimum bias events, 4.3 pb⁻¹ muon triggers and 1.8 pb⁻¹ high multiplicity triggers. ALICE reached or exceeded all data taking goals in this period. In the 5.02 TeV Pb-Pb run ALICE has been taking data smoothly up to the desired top luminosity of 1 kHz/b. All new detectors and triggers installed during the LS1 were operational, including the High-Level-Trigger (HLT) performing TPC cluster compression that, at the maximal trigger rate, reduced the data flow from 16 to 6 GB/s. Integrated luminosities of 433 μb⁻¹ were taken during the Pb-Pb run. A data volume of 7.2 PB was stored, the same as recorded during the entire Run 1. The beam induced background was reduced by a factor of 10 with respect to Run 1 thanks to improvements in the vacuum conditions due to interventions on the dump line TDI2 during LS1. During the heavy ion run, the LHC was able to provide stable beams with 60% efficiency, allowing ALICE to achieve 43% of the total integrated luminosity planned for the total of Run 2. ALICE routinely reached the desired top luminosity and started to level at L = 1×10²⁷ cm⁻²s⁻¹ for an average of 2.46 h per fill. The LHC collimation system at IR7, providing protection against beam losses and optimized for the p-p run, has been found to be less efficient for heavy ions, due to Pb fragmentation into isotopes from beam halo interactions with the collimator material. ALICE detected such beam losses with the Zero Degree Calorimeters (ZDC). Detailed studies are being carried out to reduce such beam losses in future heavy-ion runs. The
ALICE TPC gas mixture was switched from NeCO₂ to ArCO₂ (90:10) allowing stable detector response to high particle fluxes.

Anomalously large localized distortions in the TPC that scale with the interaction rate were found along the IROC edges and in the OROC centers. An intense work program was carried out to shed light on the origin of the problem and to develop the correction procedures to the level of matching the intrinsic TPC resolution. The procedure has been successfully tested and is being implemented to be ready for data production in week 10. However, the origin of the problem is still not fully understood. Current working hypotheses are those of (i) floating gating grid wires that could explain the effect in the OROC and (ii) polymers generated by gas-mixture contaminants accumulated in the drift region that could give rise to the distortions along the IROC edges, where the gating grid is less efficient in blocking back-drifting ions. A complete gas exchange is planned in the next weeks to further investigate the presence of contaminants. The LHCC recommends to make every effort to study the origin of the problem and to consider possible implications for the TPC upgrade.

The replacement of the TPC readout units (RCU2) was completed after modification and stress-test of all boards operating at 3.125 Gb/s transfer rate. This upgrade improves the TPC readout rate by a factor of 2. Laser and cosmic ray tests of the whole system are planned in week 10 and 11.

**Proton-Proton and Heavy Ion Run Plan for 2016**

During the p-p run in 2016, ALICE plans to level at a luminosity of 5 Hz/µb, i.e. an interaction rate of 300 kHz with a pile-up rate of 1-2%. The preliminary trigger setup includes a minimum bias trigger, a high multiplicity trigger as well as rare triggers targeting probes such quarkonia, jets, hard photons. The trigger mix also includes a 4-fold coincidence cosmic trigger to address cosmic bundle physics. ALICE intends to participate in the large β* run in parasitic data taking mode at their own β* of 10m. For 2016/17 ALICE aims to flip the dipole and solenoid polarities between fills similar to LHCb. According to the machine this is possible but will require a small increase of the crossing-angle in IP2.

The heavy-ion run period in 2016 offers the last chance to run p-Pb in Run 2. ALICE requested p-Pb running at 5 TeV, the same center-of-mass energy as the top energy Pb-Pb collisions. The defined goal is to collect 1B minimum bias events and 20 nb⁻¹ rare triggers. The minimum bias sample would exceed that taken in the 2013 p-Pb run by a factor of 10, providing similar statistical errors as in Pb-Pb for many key probes such as low-pt charm mesons. Due to diverging requests for the p-Pb run by the different experiments, the LHCC asked ALICE as well as the other experiments to provide a written beam use request for the heavy-ion run period including a physics motivation for the respective energy and integrated luminosity. During the May meeting, the LHCC will aim at concluding on the details of the p-Pb run.

**Upgrades**

**Status of Readout and Trigger System Upgrade**

The Phase-I upgrade programme includes multiple developments in the readout system as well as a new trigger. All upgraded detectors will have continuous readout capability. The Central Trigger Processor (CTP) underwent an engineering design review in January 2016 and is on schedule. The Common Readout Unit (CRU), also for use in LHCb, will be used by all upgraded ALICE sub-detectors. A prototype module has been tested
successfully and pre-series production is scheduled to begin in March 2016. A design review will take place in April 2016. The Fast Interaction Trigger has been tested in beams and a 20-30ps time resolution demonstrated. The Time of Flight Triggers are also making good progress, having undergone a design review in March 2016.

The SAMPA readout ASIC is used for the TPC and muon systems, where it performs base-line filtering, zero-suppression and other data compression tasks. The MPW2 SAMPA version was submitted for production in February 2016. There has been some recent reorganisation and hiring of additional personnel in the SAMPA project. The increased manpower is very welcome, given that the contingency for this aspect of the upgrade is at the level of only 1.5 months (for the TPC) and it is critical to the success of the upgrade programme. The LHCC encourages ALICE to continue to monitor the situation closely and to make contingency plans as required.

There has been a change to the TPC readout architecture to reduce risk associated with base-line filtering on the SAMPA, following observations of pedestal shifts due to capacitive coupling of electrodes in the readout structure. This is tackled by shifting base-line corrections from the SAMPA to the CRU, which will improve the flexibility to adapt algorithms to meet unforeseen operational conditions. All raw ADC values will therefore be streamed to the CRU, by-passing the DSP. If a 5MHz sampling rate for the ADCs is sufficient, there is no significant impact on the required number of CRU input fibres, or on the associated cost, whereas a 10MHz sampling rate would add substantially to both. The required sampling rate is currently under evaluation. The SAMPA chip will retain its DSP capabilities e.g. for use in the muon system.

**TPC Upgrade: Readout Chamber Test Procedures**

Following a request from the LHCC, ALICE provided a detailed plan for the testing of the new TPC read-out chambers. This included procedures for the pre-production chambers, which will be close to the final version, as well as for the production versions. ALICE foresees comprehensive commissioning tests on pre-production ROCs. These tests will be undertaken at the various assembly sites (Yale for IROC, HPD and GSI for OROC) in newly developed low-volume and thin entrance windows vessels to allow for fast flushing and full irradiation with X-rays respectively: measurement of gain, its uniformity and stability long term and discharge stability are foreseen. In particular, the full irradiation (full load of 10 nA/cm²) with an X-ray source will provide performance and stability tests of the system under full load. These tests should also validate the HV design of the ROC.

A test campaign at SPS in fall 2016 with RD51 has been scheduled. Within this test beam one pre-production ROC equipped with prototype electronics will be tested and the noise behavior of the complete front-end system will be verified.

The LHCC acknowledges the need for thorough testing procedures of all aspects of the readout chambers before and during production and encourages ALICE to follow this comprehensive plan closely.

**GEM Production in CERN TS-DEM-PMT Facility**

A recent problem concerning production of GEM foils that potentially could affect the schedule of the TPC readout chamber production has been reported. Several rolls of Copper-coated polyimide (Apical from Kaneka) foil for GEM production were found flawed resulting in a gradual variation of the hole diameter along the GEM. Detailed analysis on the material in TE-VSC-SCC at CERN is ongoing and a new tooling for tuning etching to compensate for flawed material is under construction. While this issue
should not influence the time plan for the pre-production ROCs since enough material is available, it could potentially affect the schedule for the production.

**Milestone and Risk Documents**

As requested by the LHCC, ALICE created a central repository to store documents containing timelines, milestones, and risks registry for each Phase-I upgrade project. The details of the various documents were discussed with the LHCC referees concerning format, content, and update procedures. The only project not considered was the MFT that will be discussed during the May meeting.

14. **REFEREES**

The LHCC referee teams for this session are as follows:

ALICE: C. Bloise, P. Newman, C. Sfienti, T. Ullrich (Co-ordinator)
ATLAS: P. Burrows (Co-ordinator), F. Kunne, M. Lancaster, B. Ratcliff
CMS: M. Demarteau, D. Denisov (Co-ordinator), A. Kuzmin, H. Yamamoto
LHCb: C. Diaconu, G. Eigen (Co-ordinator), T. Kuhr
LHCf, MoEDAL, TOTEM: M. Mangano (Co-ordinator), C. Bloise, P. Newman
LCG: C. Diaconu (Co-ordinator), T. Kuhr, M. Lancaster, H. Yamamoto

Experiment Upgrades:
- General: M. Demarteau (Co-ordinator)
- RD39: G. Eigen
- RD42: M. Demarteau
- RD50: G. Eigen
- RD51: D. Denisov
- RD52: P. Burrows
- RD53: M. Demarteau

15. **The LHCC received the following documents:**

- CERN-LHCC-2015-025 Minutes of the one hundred and twenty-fourth meeting of LHCC held on 2 and 3 December 2015
- CERN-LHCC-2016-003 LHCf: Letter of Intent for a p-Pb run in 2016
- CERN-LHCC-2016-004 UCG Report on the ATLAS Phase-II Upgrades
- CERN-LHCC-2016-006 UCG Report on the CMS Phase-II Upgrades

**DATES FOR LHCC MEETINGS**

Dates for 2016
- 25 – 26 May
- 21 – 22 September
- 30 November – 1 December

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