

22nd Meeting of the LHC Resources Review Board RRB

Held at CERN on 24th April 2006

1. Introduction - J. Engelen, Chief Scientific Officer

J. Engelen welcomed RRB delegates to this 22nd session. The minutes of the October 2005 Plenary Session, CERN-RRB-2005-062, were approved without comment.

J.Engelen reviewed the topics on this agenda, noting the opportunities to ask questions of the Director General during his report and the important presentation of the current LHC machine status by the LHC Project Leader.

2. CERN Status and News – R. Aymar, Director General

R. Aymar welcomed the attendees to the April 2006 RRBs. He noted that the most important message he had to deliver was that all possible efforts were being made to prepare the machine, the experiments and the computing in such a way that there would be a good start in the Summer of 2007. No doubt delegates had seen the major progress that had been accomplished in these three areas. It was important to continue these efforts with as much intensity as possible, notably because there was competition at Fermilab.

He noted that this schedule was tight for everyone. It would, however, be a wrong policy to try delay and ease the schedule because of the difficulty of the tasks. One had to be realistic as well. They had promised by June of this year to make the most rational guess as to the best date of first collisions, meaning two beams running and making contact at some point. Until June they would continue to scrutinize the various processes and points to be prepared in order to meet this date. This detailed planning was reviewed monthly for the machine, the experiments and the computing. All had their own difficulties and everyone needed some help or special efforts in their own areas. They would have to make a choice as to the best compromise between all the requirements of the machine, experiments and computing. One could not allow the last to be ready to impose the schedule. For the time being he hoped that all could be ready together. The date chosen would be announced at the Council Meeting in June 2006.

The Director General turned to the decision of the CERN Council to launch a strategy analysis by convening an ad hoc strategy group. This group held a meeting in January 2006 in Orsay, open to all scientists in this discipline in Europe. Everyone was invited to give their proposals, ideas and comments as to the future strategy to be followed. Next week at CERN there would be the meeting of the strategy group itself, around 50 people, in order to exchange views and reach a point of agreement to provide the Council with a set of options. These strategic options would be proposed to a special meeting of the Council in Lisbon on 14th July 2006 for endorsement. He considered this to be a most important meeting setting the way ahead. Options included an upgrade of the luminosity of LHC, to be prepared over the next 4 years, and more R&D for an entirely new programme. This was the first time that the Council had initiated such an action and he expected that this would not be the last time because he believed this to be an important issue.

3. LHC Machine Status Report – L. Evans, LHC Project Leader

L. Evans presented (transparencies available on the LHC RRB web pages) the current status of the LHC machine and the progress made since the previous meeting of the RRB in October 2006. He showed a number of slides from the LHC Progress Dashboard, starting with the situation of cold masses of the LHC dipoles. Out of a total of 1232 more than 1050 had been delivered and the current delivery rate had fallen to 2/3 of the previous since one manufacturer had finished

production. The whole production was foreseen to be finished in September/October 2006 for installation in the tunnel, after cold testing, in February 2007.

Similarly the cryodipole overview showed that installation was now proceeding at the required rate and that the delivery vehicle difficulties of last year had been solved since January. Currently one third of the dipoles were installed and nearly one third of the main quadrupoles. They continued to try to improve the rate of dipole installation to better than the current 25 per week.

The space in the tunnel was very tight and, up to now, transport of magnets had been during the night with the teams carrying out the interconnects working during the day, giving some inefficiency coming from the change over of a couple of hours. As of today there were two octants completely full of magnets and requiring no transports, thus allowing the interconnects to proceed without any interference. He expected this to improve seriously the rate of interconnects. Currently about 200 interconnects were complete.

The problems with the cryogenic distribution line were coming to an end. The progress dashboard showed that by early June all main component manufacturing would be complete. Installation was complete on 6 sectors. Moving to the Cryogenics Overview display, L. Evans described the detailed status of the full cryogenic system. Only in one sector had they not yet started installation. They expected to be fully back on schedule for the QRL by the end of the summer 2006 and this was a tremendous recovery.

Commissioning of the power supplies for one whole sector had started last October. Endurance tests of continuous running lasting 24 hours had been very successful and to date three sectors had been tested. This procedure ironed out power supply problems before connection of the magnets.

A committee had been formed to discuss and decide on the commissioning and operational cycle of the machine. He showed in slide 18 a proposed operation cycle. He also showed a proposal for a breakdown of a normal year of accelerator operation. If the LHC were to run as one had traditionally operated accelerators at CERN, e.g. LEP, then there would be at least 140 to 160 days for physics. The economics of LHC with its superconducting magnets were however different from previous machines since switching off the magnets of a conventional accelerator saved the power, whereas the LHC had to be kept cold and most of the power consumption of LHC was in the cryoplants and not in the magnets.

As conclusions he noted that all key objectives had been reached for the end of 2005, including the end of repair of the QRL, reinstallation of sector 7-8 and the cold test of sub-sectors A and B. The full sector 8-1 had been cooled down and there had been a pressure test of sector 4-5. An endurance test of a full octant of power converters had been made. Approximately one third of the machine was now installed. Interconnect work could now proceed in two octants without interference from other activities. In summary all efforts would be made to get a colliding beam run in 2007.

The Chairman thanked L. Evans for his presentation. The Director General noted in addition the recent inauguration of the new Control Room by the Council in March 2006. This single control room controlled all accelerators and facilities previously covered by several control rooms.

L. Evans added that they had made an appeal for extra manpower to help with the commissioning and the many parallel activities from the institutes in the member states and outside the member states. The response had been excellent and he would like to thank formally all those concerned.

Discussion

R. Wade offered his congratulations for the excellent progress. He asked whether the 7 day working was only for magnet installation or used more widely. L. Evans confirmed it was just for

magnet installation and that they tried to use 7 days only when necessary since it cost extra money. There was the possibility to speed up further by working consistently 7 days if really necessary.

F. Ferroni asked about the figure of 4×10^6 seconds/year. L. Evans replied that this was extrapolated from LEP experience and that it was not obvious that this machine should be operated as LEP because they would have to pay for the power anyway.

T. Ferbel asked if he had understood correctly 100 days for p-p running and 40 days of heavy ion running. J. Engelen replied that these numbers were a qualitative model, and certainly cautious. He wanted to consider these numbers as a conservative lower limit. L. Evans added that he had shown these numbers simply to point out that there was a dialogue between the machine and the detectors in order to arrive at agreement on the operation of the machine.

R. Wade asked about the control software and control system for the machine. L. Evans noted that with previous CERN accelerators this had been a concern, but they felt confident that the vast experience they had gained with LEP left them very well prepared for LHC. The basic software for the machine was no different apart from the cryogenic control software.

T. Ferbel asked, given the excellent progress, why one had to wait until June in order to decide the schedule. L. Evans noted that this was a complicated machine with complex detectors. There was no superconducting machine as complicated as LHC in the world. They could still have some unpleasant surprises despite the excellent progress they had made.

J. O'Fallon asked what was on the critical path for the machine. L. Evans replied that the current critical path was interconnect work and he expected this to go away shortly. As far as hardware was concerned it was cryogenic feed boxes and special efforts had been made to correct this. The installation of magnets was now on course for February 2007.

R. Wade asked who was deciding the split between p-p and heavy ion running. L. Evans noted that to run heavy ion physics you needed a heavy ion injector, and for this they had converted the LEAR ring as an accumulator for lead ions. That machine was being commissioned now. J. Engelen replied that the start of the LHC machine would be very important, with an obvious priority for p-p running, and with the obvious aim of making the LHC as competitive in that area as efficiently as possible. In order to prepare the right advice, a group consisting of machine experts, including the project leader, and the experiments, including their spokespersons had been constituted to discuss and advise the Director General on these questions. Once in a stable situation, it had always been the plan to have one month a year of heavy ion running. L. Evans noted that this would normally be at the end of the year in order to allow the complex of accelerators to cool down from radiation.

E. Gazis asked whether there would be ion beams in 2007. L. Evans replied that he thought not, as the focus would be on p-p.

In response to a question as to when the new hostel would be ready, the Director General replied that this was planned for end of June 2007.

5. Summary

In summary J. Engelen noted that there had been impressive progress.

C. Jones
April 2006