

25th Meeting of the LHC Resources Review Board RRB **Held at CERN on 22nd October 2007**

1. Introduction – J. Engelen, Chief Scientific Officer

J. Engelen welcomed RRB delegates to this 25th session. The minutes of the October 2006 Plenary Session, CERN-RRB-2007-001, were **approved** without comment.

J. Engelen explained that this plenary session would include three talks, one by the Director General, one by the LHC Project Leader, and a summary of the findings of the M&O Scrutiny Group which would be presented by the chairman by George Lafferty. He noted that they intended to create a second scrutiny group specifically for the computing and the WLCG. He would return to this in the Computing RRB.

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

R. Aymar noted that in this RRB there would be a detailed presentation on the LHC machine itself by L. Evans, and that he would address here mostly the other points that he considered to be of the importance.

The fixed target programme was now sending a neutrino beam to Gran Sasso. Commissioning of the system had started seriously this year and the first event had been found in the emulsion target a few weeks previously. Operation would continue for some weeks this year and in 2008.

Turning to matters concerning the CERN Council, R. Aymar reminded the members that, in order to finance the LHC machine, more than 1 year of CERN budget had been borrowed from the banks. The sooner this was repaid the better, not just because of the cost of the interest, but also for the reputation of CERN. The level of repayments was around 300 MCHF per year, thus leaving CERN in a very difficult position. He had asked the Council for special support during four years, 2008-2011. These extra resources were dedicated to a specific programme which had two main priorities: to prepare for the future and to make the LHC as reliable as possible. These were the two priorities decided by the Council in the special meeting in Lisbon in July 2006.

In order to make the LHC work as reliably as possible there was a need to improve the power supply for the PS which had no spare. A new power supply would be built. The connection between the PS and the SPS would be improved, which would be important for Gran Sasso. In general CERN was running in this area using components built between 1959 and 1980, and hence there was a need for some consolidation.

They needed to prepare for the future and for a possible upgrade of around an order of magnitude in the luminosity of the LHC. For this they needed for example new focussing triplets. Here there were joint developments with a number of other laboratories. They had made a proposal to the European Commission for resources to help these joint developments and they would probably be successful, even if this would represent far from the full cost.

If it were decided to go for an upgrade it would be foolish to contemplate the perspective of operating the LHC to 2025 without making a new injection line. The PS had been built in 1959.

This work programme for the next four years would be supported by a specific budget of 240 MCHF which was provided by the delegates. He thanked all the Member States but in particular the two host States who would provide half of the money between them.

R. Aymar turned to the discussion at the world level of physics beyond the LHC. This could be an electron-positron collider and there was a proposal for the ILC at 500 GeV, built on the technology of superconducting cavities. There was also work on CLIC, which was a linear collider but with a different technology that could reach possibly 3 GeV. There had been a large workshop in the previous week to discuss the status of CLIC and the programme of work up to 2010 aimed at demonstrating the feasibility of this proposal. In the timeframe of 2010/2011 one could review the first results of the LHC and the priority of an LHC upgrade, the status of the ILC and progress on CLIC. That was why he personally did not see in Europe any decision on the future beyond LHC being made before 2016.

Discussion

In response to J. Engelen's request for any questions or comments, there were no questions.

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

L. Evans presented, (transparencies available on the LHC RRB Indico pages), the current status of the LHC machine and the progress made since the previous meeting of the RRB in April 2007. He first showed the new Control Centre from which all accelerators would be operated. The Inner Triplet problem was solved. The reinforcement of the magnets in question was now complete. On the 26th April 2007 the last dipole had been installed. Altogether the magnets had travelled 30 000 km underground at 2 km/hour. Nearly 50 000 tons of equipment had been positioned to an accuracy of a fraction of a millimetre.

The magnet interconnects were now essentially all made and in three weeks would be finished. There had been a new problem with the plug-in modules. When one sector had been warmed up some of these had collapsed in to the bean pipe. However the level of the problem was very low, of the order of 1%. They had developed a simple and powerful technique for finding such faulty plug-in modules. They considered that this problem would have no impact on the schedule.

The machine was being closed up and cooled down. The cool-down was an impressive activity where each sector consisted of 4700 tons of material to cool down to -271° centigrade. The first stage of cooling down to 80° Kelvin needed 1200 tons of liquid nitrogen, which was 64 trucks of 20 tons for one sector. In order to compensate for the burn off, they needed another truck every four hours for about 2 weeks. At this stage they started to refrigerate down to 4.5° Kelvin. The final stage was to reduce the temperature of the helium by reducing the vapour pressure. The first time that they tried this, things had taken longer than foreseen with numerous problems. He hoped that the experience gained would enable them to go faster with the other sectors. The next stage was the power tests, ramping up the power supplies, including forced quenching. The next sector to be cooled down was 4-5.

L. Evans presented pictures of the four RF cavities for LHC which were also superconducting. He showed and explained the latest general schedule dated 8 October 2007 (slides 14/15). The plan was for first beam from the injectors to be available around the 21st May 2008. They intended to be ready to inject that beam into the machine, always assuming that they did not have any more bad surprises. That would imply closing the detectors at the end of March or so.

Discussion

J. Engelen thanked L. Evans for this presentation and opened the floor for discussion. T Ekelof asked whether the power tests that would take place in May-June on the schedule would interfere with machine. L. Evans explained that these power tests were in order to push up the energy. They would start at injection field and then push up from there.

4. Report from the M&O Scrutiny Group – G. Lafferty, Scrutiny Group Chair

G. Lafferty presented the general part of the report of the RRB M&O Scrutiny Group. He noted that he would make remarks specific to each experiment during the respective experiment RRBs.

The composition of the SG had been, for different reasons, effectively three active members short and he was grateful to the other members who worked particularly hard in order to compensate. Nonetheless there was a real need to make sure that next year there would be a full complement of active members.

He reminded delegates of the mandate of the SG to:

- assist the RRB by analysing critically the collaborations' M&O reports and estimates, refine the Category A estimates in consultation with the collaborations and advise the RRB ...
- make also critical comment on the arrangements for Category B costs

The SG operated during the summer, with the aim of agreeing the estimates for Category A for the following year. This year ATLAS Cat B M&O was subjected to a higher level of scrutiny than usual, as requested by the April RRB.

He summarized the Category A M&O spending overview for 2006:

Experiment	Budgeted costs kCHF	Actual costs kCHF
ALICE	2733	2531
ATLAS	8765	9309
CMS	6952	6890
LHCb	1478	1463

And the Category A M&O requests for 2008:

Experiment	Total(excl power) kCHF	Total (incl power) kCHF
ALICE	4591	7183
ATLAS	11994	14194
CMS	10159	11959
LHCb	2345	2645

G. Lafferty reviewed the activities of the Scrutiny Group from May to September 2007, including that of the various sub-groups. In particular, they now had a new set of Summary Tables for M&O-A, which had been driven by V. Luth, working together with the resource coordinators. These allowed a more meaningful comparison of the budgets and their evolution than had been possible previously. He personally wished to thank V. Luth for this major effort and also the resource coordinators for their cooperation and hard work to bring the numbers into a reliable and comparable form.

Slides 9 and 10 showed the evolution of the M&O-A budgets of the four experiments from 2002 up to 2011. The accumulated missing contributions, being the integral of the differences between contributions received and those invoiced to the Funding Agencies were also shown. There was some evidence that this was flattening off rather than getting worse but the problem had certainly not gone away. There were of course contributions still coming in.

Service Contracts represented a rather large component of the M&O-A, where experiments paid CERN departments to provide a number of services related to e.g. beam pipes, vacuum systems, cryogenics, magnet controls, power converters, cooling and ventilation, power distribution, safety

and access controls, surveying, gas distribution, heavy lifting and transport. This was expected to grow as a proportion of total spend during the exploitation phase and the Scrutiny Group expected to continue to monitor and scrutinise these service contracts to ensure that they remained good value.

The TOTEM experiment had been a new and special case this year. The M&O budget request for TOTEM was tabled at Scrutiny Group meeting on September 25th and the SG had insufficient meeting time left to consider this in detail. The members of the Scrutiny Group felt they needed time to gather more information about TOTEM and also that the budget request needed more written justification. TOTEM was now working to produce additional material. The SG expected to meet in November/December, with as many SG members as possible, to scrutinise fully the TOTEM requests.

Following discussion at the April RRB, the ATLAS M&O-B request was scrutinised in more detail than usual. ATLAS had in place internal scrutiny for M&O-B, whereby each subsystem's needs were reviewed by a small group, whose chair reported to the overall resource coordinator. The Scrutiny Group had a half-day meeting with ATLAS that included discussions with resource co-ordinators for all the subsystems. Written documents were provided to justify requests for all the subsystems.

G. Lafferty showed a snapshot of the e-Paperwork of the Scrutiny Group over the summer. This plethora of papers and tables was a serious issue for the SG which would only get even more difficult with the inclusion of TOTEM. Work was hampered by lack of coherent naming conventions, frequent updating, no coherent cataloguing, lack of sec/admin support etc. The SG needed a system for naming, categorising and cataloguing all submissions to the SG, which made it easy for everyone to know what was what and where to find it. He proposed to work with the new scientific secretary to produce an effective system before the 2008 scrutiny process. This would not involve any more work for the RCs (other than perhaps changing the names of their files).

G. Lafferty reviewed the Membership of the Scrutiny Group for 2008 (slide 16). There was a need to find three new members to replace V. Luth representing the USA, Mark Winter who represented France or perhaps a large member state, and a delegate was still needed to represent the smaller member states. He wished to acknowledge particularly the long service and hard work of V. Luth who had stayed more than five years with the group. A new scientific secretary had also to be found for C. Jones for whom this was the last meeting.

G. Lafferty concluded as follows:

- The Scrutiny Group had carefully examined M&O Cat A requests for 2008 for ALICE, ATLAS, CMS and LHCb
- The SG had taken note of M&O B requirements where available, but had scrutinised the ATLAS figures in more detail
- The SG intended to devote similar effort to the scrutiny of requests from TOTEM between now and the end of the year
- Thanks were due to all members of the SG for their hard work, and to the resource coordinators for their cooperation, depth of knowledge and patience, and for the quality of their written and verbal input to the scrutiny process
- The RRB-SG recommended that the 2008 estimates for the M&O budgets for ALICE, ATLAS, CMS and LHCb be approved by the RRB.

Discussion

J. Engelen thanked G. Lafferty for his very clear and accurate presentation, and called for any questions or comments.

F. Ferroni questioned why the M&O-A, once it had reached what seemed to be a plateau, should stay constant as on the graphs shown, there was no law of nature that made it so. G. Lafferty agreed that the experiments had not started running yet and there was some uncertainty about how the costs would evolve. They might go down or up over the years and he did not think any of the resource coordinators could say for sure which at this stage. There were nonetheless some large drivers like the replacement of computing equipment, gas systems and service contracts and these would probably change little over the years. Probably one had to wait one to two years in order to find out.

T. Ferbel was surprised that the SG wished to look at the physics of TOTEM. G. Lafferty had not meant to imply that, but some members of the SG had not been very familiar with the configuration and aims of the experiment and wished to understand the overall context in which they should review the M&O budget.

5. Summary

There being no further questions, J. Engelen thanked the speakers and closed this plenary session.

<p>The next RRB meetings in 2008 are provisionally scheduled to take place at CERN on Monday 14th, Tuesday 15th and Wednesday 16th April 2008 and on Monday 10th, Tuesday 11th and Wednesday 12th November 2008</p>

C. Jones
November 2007