SCHEDULING LHC OPERATION - DISCUSSION

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MACHINE CHECKOUT AND SETUP PERIODS

R. Saban noted that the statement that the machine is not ready for beam at the end of hardware commissioning may indicate that something is missing from the HWC activities. A better definition of the end of HWC may allow the remaining activities to be minimized – or even suppressed. J. Uythoven replied that it might be possible to tailor the exit conditions of the HWC better, but noted that some sectors will have been off for several months and therefore some re-commissioning will be needed in any case. The role of the operations teams at this point requires further clarification.

S. Myers pointed out that the quoted figure of 6 weeks from the end of hardware commissioning to start-up with beam, together with the minimum 2 months initial beam commissioning to 1st collisions is too long. Here a more careful analysis of the activities is needed. For each activity it will be necessary either to prove that the time is needed, or to parallelize activities more in order to keep the overall time down.

R. Bailey noted that the phase III corresponds roughly to the annual checkout. On the one hand the annual checkout might be shorter since more experience has been gained. On the other hand it might be longer since there will not be a hardware commissioning phase before.

LHC SCRUBBING RUNS

O. Bruning noted that previous presentations have shown that a SEY of <1.3 and even <1.1 will be needed for nominal operation. He went on to ask what the level of confidence is that we can achieve these levels. In reply, M. Jimenez explained that the scrubbing in the field-free monitors installed in the SPS stopped at a SEY of 1.5, since the electron cloud itself stopped. In the arcs the machine scrubbed further, but no detailed data are available. As long as the electron cloud can be generated, scrubbing should continue.

M. Jimenez went on to note that the importance of the SPS studies is much more for benchmarking the simulation codes – since direct interpolation from SPS to the LHC is very difficult.

R. Assmann asked about recent studies which indicate that the impedance of the e-cloud is very high. This may mean that we cannot keep the high intensities required for scrubbing sufficiently stable in the presence of electron cloud. M. Jimenez agreed and added that studies are underway in ABP.

P. Collier asked if any problems are foreseen with electron cloud in the transfer lines, since e-cloud was observed in The PS-SPS transfer line. M. Jimenez replied that the e-cloud will undoubtedly be observed in TI2 and TI8. However with only a single pass this should not pose any severe problems. It will generate a small ΔP, but this will be highly damped since we extract beam relatively infrequently.

ACCESS SYSTEM AND ITS IMPACT ON LHC OPERATION

S. Baird wanted clarification that the same access system would be in use for both machine and experiments. G. Roy confirmed that this is the case. Control can be passed from the main control room to the experiments under specific conditions – but safety rests in CCC.

S. Myers recalled that during periods of access in LEP getting people in was no problem, getting them out was another matter. He went on to ask what steps would be taken in the LHC to avoid the machine being blocked unnecessarily in access? G. Roy answered by noting that there will be no general announcement system in the LHC. However there is full GSM coverage. The EiC/Coordinator can therefore call the people up and request that they leave. He added that the beam immanent warning cannot be triggered until the machine is actually closed.

F. Bordry requested clarification regarding the difference between beam zones and service zones. G. Roy replied that one essential difference is that in the case of beam zones it is necessary to wait for the air to be exchanged before access can be given. In addition, if there is a radiation veto for the specified beam zone an RP piquet will be required

R. Saban wanted to know if an immediate access can be given to a beam zone in the case where a radiation veto is not present. The answer was, in principle, yes. Of course the time for air renewal must be respected. G. Roy added that the radiation veto will be progressively deployed as needed. This deployment will be as a function of the activation in the different zones.

In answer to a question on the biometric scans G. Roy noted that two different biometric scans are under consideration at the moment: iris scans, or fingerprints. In either case scan and identification should take around 2 seconds.

EQUIPMENT MAINTENANCE POLICY AND REQUIREMENTS

R. Bailey noted that maintenance is mainly outsourced. Compressing maintenance into the scheduled stops of the machine therefore implies writing it into the outsourcing

contracts, including the need for interventions at short notice. He went on to ask specifically about the situation for the maintenance of the lifts. T. Pettersson replied that in the case of the lifts we should look into the possibility of scheduling the lift work in the first few hours of a stop.

R. Assmann pointed out that some areas - notably the cleaning zones - will become very radioactive and asks if this is taken into account for maintenance policies. The reply was yes. Clearly the activation of the equipment to be maintained has a very important impact.

Since all material in the LHC will have to be traced to conform to INB regulations, R. Saban wanted to know if this could be achieved using the system described. T. Pettersson replies that the system being deployed for the LHC will cover the needs of the authorities. It will be possible to say where each object has been and for how long. From this we should be able to work out its exposure. He went on to note that there are already 250,000 objects defined in the system.

EXPERIMENTS' DESIRES AND CONSTRAINTS DURING THE EARLY LEP OPERATION

O. Bruning requested clarification concerning the state of the LHCb magnets in normal operation. D. Macina replies that they will be on at injection and ramped with the machine. Oliver went on to ask what the tolerance on zero crossing angle for Totem is. Here no information is available. Finally Oliver noted that operation at $\sqrt{s}$=1.8 TeV will not be possible with 1.5km β^* since the beam size will be significantly larger at lower energies. What is possible for operation at this energy should be looked at.

S. Myers pointed out that the experiments desires cover a huge range in intensity, number of bunches, β^* and luminosity. D. Macina replies that the list given probably covers the first 5 years of operation. Even so, a clear prioritization will be needed and S. Myers went on to note that such a prioritization would need the help of a physics co-ordinator.

A. Ball clarified the situation for the installation time for the pixel detector. The intervention time is dominated by the vacuum work. R. Bailey asked what drives the time for the request from CMS for the first shut down. A. Ball replied that it is driven by CMS's understanding of the LHC start-up. The pixel detector is better used once the background situation is better understood. The e-cal end caps will not be available before summer 2007. CMS would like to install them as soon as possible afterwards.

R. Assmann mentioned that no request for studies on background and collimation has been received from the experiments. The tertiary collimators are installed principally to protect the inner triplet and may even be a source of additional background to the experiments. There is a need for clear information here between the collimation people and the experiments. D. Macina replied that studies of the background situation for the LHC experiments have been based on the pressure in the LSS where the background is dominated by beam gas interactions. Background may become a problem if the pressure is too high. The possibility that the collimators might be an additional source of background has not been studied. She went on to note that there is presently no request for additional collimators from the experiments.

LHC OPERATION WITH HEAVY IONS

J. Schukraft requested that all figures and tables concerning ions should routinely show all three experiments operating since they are now all approved.

S. Baird wanted clarification regarding the difference between early and pilot ion schemes. J. Jowett replied that a pilot run would be similar to the pilot p^+ operation. On the other hand the early scheme is the 62 bunch scheme. The pilot would not cost much effort and could give the first real physics results form the LHC – even with a luminosity $\sim 10^{+25}$.

OPERATION FOR TOTEM

O. Bruning noted that Totem operation requires non-standard optics in the interaction regions. The quality here and the commissioning time will depend heavily on our knowledge of the transfer functions for the insertion quadrupoles. He went on to note that these transfer functions will only be measured for the nominal squeeze and not even that for some magnets. Oliver also noted that the separation/recombination systems in the high luminosity regions use a combination of a warm D1 and a cold D2. Optics changes and physics operation at different energies implies different relative behaviour of the warm and cold devices and will lead to additional complications for operation under these conditions.