10 May 2002

AD-HOC WORKING GROUP ON LHC EXPERIMENT-MACHINE PARAMETER AND SIGNAL EXCHANGE

Minutes of the 2nd Meeting held on 26 March 2002

Present: R. Assmann, A. Ball, P. Baudrenghien, G. Beetham, K. Eggert, N. Ellis, K. Gill, R. Jones, D. Macina, A. Smith, W. Smith, B. Taylor, E. Tsesmelis

Apologies: K. Cornelis, D. Evans

1. APPROVAL OF THE MINUTES

The minutes of the 1st Meeting were approved with the following modification: in point 2 (Luminous Region: Size and Stability), the first sentence in the last paragraph should be replaced by: `The machine group will install pick-ups 150 m from the IP for use by the experiments.'

2. MATTERS ARISING

In order to optimise the LHC machine performance in the initial stages by lowering the stored energy and reducing the electron cloud effects, the LHC machine groups would like to start up operation with a 75 ns bunch spacing. The experiments also support such a strategy for the initial timing-in phase of their equipment. However, further discussions are needed to evaluate when a change-over to the nominal 25 ns bunch spacing should be made. The experiments ask the machine groups to provide them with scenarios of the initial operating conditions of the LHC machine that will result in the 10 fb^{-1} of integrated luminosity requested by the experiments. **[Action: LHC machine and experiment representatives]**

In addition, studies on the size of the luminous region are encouraged to continue. In particular, the results presented by Philippe Baudrenghien at the 1st Meeting should be updated taking into account the crossing angle of the two beams. Moreover, the bunch profiles and hence the luminous region should be weighted with the expected decrease in luminosity over the time of the fill. **[Action: Philippe Baudrenghien, Werner Herr]**

3. THE LHC BEAM POSITION SYSTEM (ANNEX I)

(Rhodri Jones)

Rhodri Jones presented the status of the LHC Beam Position Monitoring (BPM) system. A total of 1166 BPMs are needed for the LHC and its transfer lines. This includes 1 BPTX timing pick-up per incoming beam for IR 1, 2, 5, and 8. The BPTXs will be located about 150 m from the IP in front of the D2 magnet and will be used exclusively by the experiments. The choice of the pick-up technology will be made in collaboration with the experiments. Possible technologies include a stripline coupler, button electrode or wall current monitor.

The choice of technology and location of the front-end electronics will determine requirements for the cables. Although the cables for the BPTXs will be procurred and installed by the LHC Machine, it will be under the financial and logistical responsibility of the experiments. Since the fast controls and DAQ inputs of the experiments are in the undeground counting rooms, the experiments expressed an interest to pull their cables to their galleries in the underground areas and thence to their underground counting rooms. Rhodri stressed that it is now urgent for the experiments to decide on the cables and racks as orders for the machine are being made. **[Action: LHC experiment representatives]**.

The front-end electronics will also be under the responsibility of the experiments and care must be taken to ensure that they are radiation resistant if they are required to operate in the LHC tunnel. The electronics should be a common development between all the experiments. **[Action: LHC experiment representatives]**.

In addition to the timing information provided by the BPTXs, the experiments would also like to know the individual bunch currents. This can be provided by the fast current transformers at Point 4. The data is intended to be updated around every minute. Similarly, the longituninal bunch structure will be measured by Longitudinal Profile Monitors at Point 4. The measurements, to 50 ps resolution, are also foreseen to be updated every minute or so and should be directly applicable to the experiments as the profiles should not vary significantly from Point 4 to the IPs.

Further discussions are needed between the experiments and LHC machine to clarify how the data from all these monitors will be delivered to the experiments. **[Action: LHC machine and experiment representatives].**

4. ATLAS MEASUREMENTS ON COLLISION QUALITY (ANNEX II)

(Nick Ellis)

Nick Ellis reported on measurements on the collision quality that ATLAS can perform. The experiment intends to measure continuously and individually for all bunches trigger rates at both the Level-1 Trigger and Higher Level Trigger stages. Assuming that the background contribution to the rates is small, the measurements will be proportional to the luminosity. ATLAS asks the LHC Machine groups to provide them with the timescale at which the accelerator wants this information and details on the intended communication mechanism between the machine and experiment. **[Action: R. Assmann]**

Moreover, ATLAS anticipates monitoring the beam position by reconstructing tracks in the Inner Detector. The experiment could provide a measurement to 10 μm transverse position accuracy and 2 mm longitudinal position and size accuracy, both within about 10 s. As above, ATLAS would like to know the timescale and communication mechanism that this data should be exchanged with the LHC machine. **[Action: R. Assmann]**

Finally, studies for the ATLAS Inner Detector reconstruction have shown that in order to preserve the assumed performance of the ATLAS, the experiment notes that at most 5% of the integrated luminosity may be outside the region z = ±112 mm. Also, a transverse positioning accuracy of a few mm is required.

5. CMS-LHC MACHINE SIGNAL EXCHANGE (ANNEX III)

(Wesley Smith)

Wesley Smith reported on the expected CMS runtime signal exchanges with the LHC Machine. Data from the Tracker (for the measurement of the collision z distribution, x & y position and luminosity), from the Muon Spectrometer (for the determination of the muon halo and the size and distribution of the neutron background) and from the Hadronic Calorimeter (to measure occupancies, the x & y position and the luminosity) are anticipated to be available and to be communicated to the LHC Machine. CMS would like to know what signals the LHC Machine operation crew would like to have from the experiment. **[Action: Karel Cornelis]**

Moreover, in order to protect the detectors, CMS is developing a radiation monitoring system, based on solid-state devices, which will request abort of the beam on observing spurious beam behaviour. Specifically, CMS is investigating use of diamond detectors on the beampipe at ±190 cm from the IP, which is the nearest point to CMS at small radius on the beampipe before pipe becomes conical. This system will be independent of the CMS Pixel Detector and thus can be used during periods when the Pixel Detector is not operational, for example during a pilot run. Further discussions are required with the LHC Machine in the design of the system and in particular what signals will create conditions to send a request for a beam abort.

In addition, although frequent adjustments to the RF clock are not expected, CMS would like to know from the LHC Machine what adjustments are foreseen, by how much and how often. **[Action: Philippe Baudrenghien]**. CMS expects not to be affected by changes to the RF timing of less than 0.5 ns.

Finally, Wesley requested on behalf of CMS that the LHC Machine should provide the 4 quadrant signals from each BPTX pick-up.

6. A.O.B

Information on the Working Group may now be found on the World Wide Web at URL - http://cern.ch/lhc-data-exchange.

7. NEXT MEETING

The next meeting of the working group will be held in the middle of June, with the exact date to be confirmed in due course.

E. Tsesmelis