

## AD-HOC WORKING GROUP ON LHC EXPERIMENT-MACHINE

### PARAMETER AND SIGNAL EXCHANGE

#### Minutes of the 5th Meeting held on 21 October 2002

Present: R. Assmann, K. Eggert, N. Ellis, D. Evans, K. Gill, P. Grafström, W. Herr, M. Huhtinen, R. Jones, D. Macina, R. Schmidt, A. Smith, W. Smith, E. Tsesmelis

#### 1. APPROVAL OF THE MINUTES

The minutes of the 4<sup>th</sup> Meeting were approved without modification.

#### 2. REPORT AND DISCUSSION ON THE LHC CROSSING ANGLE

*(R. Assmann)*

Ralph Assmann presented the status of the discussions concerning the beam crossing at the LHC.

It was noted that the inner triplet aperture constrains the value of the crossing angle and presently the angle is close to the limit of the available aperture. The baseline crossing scheme of alternate crossing planes at IR1 and IR5 is predicted to be beneficial for compensation of long-range beam-beam effects along the bunch train (PACMAN effects), while crossing schemes without such alternate crossing angles would not provide this compensation.

All crossing angle planes are possible for large values of  $\beta^*$  (up to about two times larger than the nominal  $\beta^*=0.5$ ). The discussion concerning the plane of the crossing angle, is therefore, only pertinent at the nominal LHC luminosity ( $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ ), assuming that the initial luminosity running is performed with a larger than nominal  $\beta^*$ .

In order to respect the LHC installation schedule, the beam screens must be ordered before mid-December 2002 (see Annex - 'Beam Screens for Inner Triplet'). This is compatible with the installation of the first inner triplet during the first quarter of 2005. The decision on the beam screen orientation can be made when the inner triplet magnets are installed. The present baseline is the race-track beam screen and a 'marguerite' shape would not be ready for the scheduled triplet installation. If required, the racetrack screens could be replaced after initial luminosity running with a 'marguerite' shape.

Finally, it was noted that the LHC Machine has no strong argument to change the crossing from the baseline other than providing greater flexibility in case that operational conditions at IR1 and IR5 are very different.

In view of the above discussion and at the request of the representatives from the experiments, a message was prepared and sent to the Chairpersons of LEMIC and the LCC summarising the position of the experiments (see Annex - 'Message to Chairpersons of LEMIC and LCC').

### 3. ACCIDENTAL BEAM LOSSES AT POINT 5

*(Mika Huhtinen)*

Mika Huhtinen presented results from simulation studies of various beam accident scenarios. Two accident scenarios were studied: a single abort kicker module pre-fire and an unsynchronised beam abort. The former is considered to be a very unlikely worst-case scenario while the latter could be a very likely occurrence. Beam abort malfunctions affect primarily CMS and TOTEM since they are the only experiments neighbouring the dump insertion at IP6. Results of the studies show that the integrated dose/flux from a full beam loss would amount to about 10 days of nominal running at the LHC. Therefore, integral effects from beam losses are considered to be negligible. However, the accident duration of the above two scenarios is only 86  $\mu\text{s}$  (with  $4 \times 10^{13}$  protons lost at IP5) for the kicker pre-fire case and 0.26  $\mu\text{s}$  (with  $1 \times 10^{12}$  protons lost in IP5) for the unsynchronised beam abort, leading to significant dose rates.

Without any protection system, an accident with the kicker pre-fire would lead to a physical damage of the inner triplet quadrupoles at Point 5 while an unsynchronised abort would result in a quench of these magnets. An absorber (TDCQ) at IP6 has been approved in order to protect the LHC machine (and CMS/TOTEM). However, care must be taken that the efficiency of this absorber is as close as possible to 100%. A fully-efficient absorber would eliminate the losses at IP5. In any case, the above study provides a good indication of dose rates resulting from beam accidents equivalent to about  $10^7$  times the nominal running conditions in the CMS Tracker.

Tests with beam simulating the above dose rates were performed at the primary proton zone of the PS. The so-called 'one-shot' tests were carried-out by CMS on silicon devices and analysis of the data is underway. The work will be presented at a future meeting of the WG.

### 4. A.O.B.

Future meetings of the WG will be held on the following Mondays starting at **16:00** in the **Conference Room Bat. 14-4-030**.

#### **Provisional Dates for 2002 Meetings:**

18 November

16 December

**Provisional Dates for 2003 Meetings:**

27 January  
3 March  
7 April  
26 May  
7 July  
18 August  
13 October  
1 December

**E. Tsesmelis**