LHC Beam Operation Committee

Notes from the meeting held on 25th September 2012

Participants

1. Summary of p-Pb tests and Preparation of p-Pb run (Reine Versteegen)

R. Versteegen summarized the p-Pb tests of week 37. Whereas the **pilot run was very successful,** the studies of the intensity limit could not be done due to various (partly unrelated) technical problems.

R. Versteegen explained that during the tests, **problems with injecting Pb into the right bucket (mitigated)** and problems with the **sensitivity of the IR6 interlock BPMs** (different sensitivity range for B1 and B2 interlock BPMs needed) were identified.

Furthermore, for high intensity operation, **new collimator settings are needed** since the beams are off-centered by about ±0.5mm in the arcs. This implies a **significant set-up time.** Intermediate loss maps were done, which are qualitatively as expected but still need to be verified quantitatively.

R. Versteegen summarized the emittance-related observations, studies and beam diagnostics requirements and pointed out that **for beam 1 horizontal and beam 2 vertical, an increased emittance growths is observed, which cannot be explained by IBS.**

The expected proton intensity stability limit is about 300 bunches. **A dedicated MD on the intensity limitations is proposed.**

R. Versteegen concluded by presenting a draft commissioning plan and the expected peak luminosity and luminosity lifetime (cp. slides).

Discussion:

B. Dehning informed that the **beam 2 BGI may not be available before LS1.** An access which includes opening the vacuum is needed. It is not sure if this intervention will be scheduled before the p-Pb run in 2013.

G. Papotti reminded that the available MD time is very limited and that it is not guaranteed that the proposed MD on the intensity limitation will be scheduled. J. Jowett pointed out that in case the intensity limitations are not addressed in advance, they may be encountered during the p-Pb run, without time for proper mitigation studies.

J. Wenninger asked when the decision on the final β* values will be taken. J. Jowett explained that aperture measurements are envisaged for the end of 2012. Based on this, the decision for β*=60 cm or β*=80 cm will be taken.

2. Vacuum Activity around the MKIs and Threshold Values (Mike Barnes)

M. Barnes explained the layout of the injection kickers (MKIs), the associated vacuum systems and the anti e-cloud solenoids. During TS#3 2012, MKI8D (Pt.8) was replaced by a revised magnet. Among others, the new MKI tank has 19 (instead of 15) screen conductor wires and a NEG coated copper bypass tube.

M. Barnes elaborated on the effect of increased vacuum pressure in the MKIs and pointed out that **the risk for an electrical breakdown (flashover) increases with the instantaneous and the integrated pressure.**

M. Barnes summarized the observations of various 25/50ns scrubbing tests and related MDs. He illustrated that the **anti e-cloud solenoids have a significant influence on the pressure, especially in the MKI interconnects**, but also in the MKI tank. Typically a **threshold current ≤3A** is needed to mitigate electron cloud activity in the MKI interconnects (there are no anti e-cloud solenoids inside the MKI tank).

M. Barnes elaborated on the breakdown of MKI8D (new) on 24.09.2012. **The flashover occurred without beam circulating in ring 2 and without beam being extracted from the SPS. The vacuum activity around MKI8D was clearly induced by the circulating beam 1.** The anti e-cloud solenoids were operated at 3A. A later increase of the current showed that **the threshold to mitigate electron cloud in the MKI interconnects was >3A.**

Presently, there are **SIS injection interlocks on the integrated pressure** in the MKIs, which are reset when a sublimation is performed (typically during each TS) and on the **instantaneous pressure inside the MKI tanks.** An additional **interlock on the instantaneous pressure in the MKI interconnects** is foreseen to be implemented before the 25ns scrubbing run.

For the 25ns scrubbing run, M. Barnes strongly suggested to keep all anti e-cloud solenoids active at all times (apart from dedicated tests).

Discussion:

G. Arduini asked which long-term conditioning plans are foreseen for the MKIs. M. Barnes answered that various mitigations for the time after LS1 are under active investigation. For the ceramic chamber, a **Cr_2O_3 coating** may significantly reduce the SEY.

G. Arduini asked how the electron cloud activity in the MKI interconnects and the ceramic chambers are coupled. M. Barnes explained that the electron cloud in the MKI interconnects can be mitigated by the anti e-cloud solenoids. The solenoids do not have a major impact on electron cloud activity within the ceramic chambers, though.

M. Lamont asked how long a MKI sublimation takes. M. Barnes answered that it takes several hours including access time.

G. Arduini asked where the instantaneous pressure interlock levels are and if they can be increased for the scrubbing run. M. Barnes replied that **the interlock levels are at 2E-9 mbar for the pressure inside the MKI tanks and at 5E-9 mbar in the MKI interconnects and at the Q5 side of the MKIs (proposed). In previous scrubbing runs, the interlock levels were increased by 25%.**

G. Arduini noted that with the present limits the MKI might become the bottleneck for the injection of a large number of bunches with 25 ns beam and will limit the electron dose rate to scrub the arcs (which is the main aim of the scrubbing run).

3. Scrubbing Run: TDI, MKI and MKE interlocks (Jan Uythoven)

J. Uythoven explained that **beam induced heating may lead to a deformation of the TDI**, which implies special limitations for the 25ns scrubbing run. He suggested to use the **vacuum pressure at the TDI as temperature indicator** and proposed corresponding thresholds. If the vacuum pressure is above these levels the **MKIs should be set to standby and the TDI shall be retracted to its parking position.**

J. Uythoven elaborated on the TDI interlocks and explained that the **retraction of the TDI with the proposed procedure does not imply any significant additional risk.**

Furthermore, it is proposed to **pulse the MKIs without beam injection before the nominal injections for UFO studies.** J. Uythoven presented a corresponding procedure, which also **reduces the risk of a MKI flashover with beam impact.**

Discussion:

G. Arduini pointed out that during the scrubbing run **the vacuum at the TDI may be dominated by electron cloud rather than temperature induced outgassing** and asked if the proposed TDI vacuum pressure limits are realistic. ***Amendment:*** It was found that for the 25ns scrubbing run, it can indeed be expected that the vacuum pressure at the TDI is dominated by electron cloud. Thus, it is proposed to **retract the TDI for at least 15min after being in nominal position for 15min.**

M. Lamont added that both beams share a common beam pipe at the TDI. **The beam induced TDI heating is dominated by the counter-rotating beam.**

Upcoming meetings:

Tuesday, 2nd October 2012 15:30 in 871-1-011: LMC

Reported by Tobias Baer