LHC Beam Operation Committee

Notes from the meeting held on 17th January 2012

Participants

1. Vacuum Activities During Xmas Brake: CMS and LS2,8 – V. Baglin (slides)

V. Baglin presented the vacuum activities performed during the Christmas stop at CMS and in point 2 and 8 as a follow-up of vacuum spikes observed in these regions and following the observation of damaged RF contacts close to the Point 2 TCTVB from X-ray images taken for the investigation of an aperture bottleneck observed between TDI and TCTVB left of point 2. At CMS, x-ray inspection showed that, for 1 of the 4 inserts, the RF fingers were inside the insert instead of being outside (see slides) determining a bad or absent RF contact and a possible aperture restriction. It was also observed an in-situ length longer by 1 cm with respect to the nominal value. A possible explanation is that the fingers fell inside the insert while adjusting the position of a movable flange to solve some leak problems. The non conform insert will be exchanged in Ne atmosphere (on January 18th) in order to avoid a full bake out of the CMS vacuum sector. A new x-ray inspection will be performed after vacuum reconditioning and bake out to verify the status of the RF fingers. This action might induce up to 1 week delay of the CMS activities.
X-rays at the D1 in LSS2 and LSS8 showed up the presence of lose springs in VAMTF induced by beam heating. The RF fingers at the location of all these modules (8 in total) will be shortened and ferrite inserts will be implemented in each cavity. As a consequence, the 5th axis of TCTVBs is condemned (see ECR 1179000). No delay is foreseen for this activity.

Discussion:

J. Uythoven asked if also the periodic vacuum increase (over 1-2 hours) observed at CMS during 2011 operation could be explained with the lack of the RF contact.
V. Baglin answered that this could be one reason but it is difficult to disentangle this from any beam induced effect.
G. Arduini asked if there is any alternative way to replace the RF insert without breaking the vacuum in CMS in order to avoid the 1 week delay.
V. Baglin replied that this is not possible since there is no element that could be moved to access the insert.
B. Dehning asked what was the reason to use, in the original design, long RF finger at the VAMTF location.
V. Baglin explained that this was done to accommodate the 5th axis of the TCTVB (used to move the jaw horizontally and provide fresh material in case of local damage of the jaw surface).
G. Arduini asked if any evidence of aperture restriction was found in IP2 and, in particular, at the TCTVB.
V. Baglin explained that no obvious obstacle was observed

2. Margin for Beam Position Interlocking at the TCDQ, Analysis of 2011 Data– J. Wenninger (slides)

J. Wenninger made a presentation on the available margin for the beam position interlock at the TCDQ, on the basis of 2011 data analysis. He explained that 2 redundant BPM sensors, located at about 1 m from the TCDQ, are connected to the SIS and that the interlock takes into account the beam position at the TCSG close to the TCDQ. Other interlocks on the relative position between TCSG and TCDQ are also implemented. The beam position, averaged over 1 minute for all energies and a beam intensity >1e14 p+, has been calculated for the July-August and September-October periods. For both beams, it was observed an improvement on the width of the distribution from 1.2 mm to 1 mm but a bigger offset (away from the TCDQ jaw) with respect to the reference position during the second two months. The effect of the temperature on the BPM readings could play a role in the measured variations but this is difficult to be quantified.
An interlock limit of ± 1.1 mm (± 1.4 σ) was used in 2011. Taking into account position spread and offset from reference, a somewhat tighter setting could be envisaged in 2012. The option of having the interlock only on the most critical side (away from TCDQ jaw) is considered for 2012 operation. A factor of 10 improvement in the beam position stability at this location is still required to match the design requirements (TCT/TCDQ retraction = 0.1 σ).

Discussion:

R. Bruce asked what minimum margin is recommended for the retraction between IR6 collimators and the TCTs.
J. Wenninger answered that this is ≥1.5 sigma that is compatible with the tight collimator settings proposed for 2012.
M. Lamont asked if this is valid also for the 60 cm β^* optics.
R. Bruce confirmed that this is the case since in his calculations he considered some margin and a pessimistic aperture. He added also that, more than the 0.1 σ retraction between TCT and TCDQ, one should take into account the 0.6 σ retraction to the TCSG in point 6.

3. TDI Beam Screen Deformation – R. Losito (slides)

R. Losito reported on the observations made during inspection of the TDI in IP2 (upstream side) and IP8 (downstream side) to check the status of the jaw coating. He explained that the coating seems to be intact but that the beam screen fell by few cm and presents a clear deformation. This is particularly true for the upstream part of the TDI in IP8, where a bump of 25 mm on the left and of 40 mm on the right side of the jaw has been measured (see slides). According to the LHC design report, the

beam screen should have been made of stainless steel while it is made of Cu. R. Losito explained that, probably during the bake out, copper became soft and deformed and this could become even worse with a new bake out.

Discussion:

V. Baglin commented that both TDIs were baked out also on surface and no deformation was observed at that time.
M. Lamont asked if it is possible not to re-bake out the TDIs.
V. Baglin answered that one could reactivate the NEG but vacuum spikes of 1e-8 mbar have to be foreseen. He suggested that a bake out at lower temperature could instead be envisaged.
G. Arduini asked if it is possible to perform radioscopy after the bake out.
R. Losito answered that the thickness of the tank would make any observation difficult but it could be tried.
M. Giovannozzi pointed out that this kind of deformation could explain the asymmetric aperture restriction measured in point 2.
G. Arduini confirmed this since, in IP8, the bump limits the aperture to 80 mm (on the side where no beam is circulating). He suggested that a new inspection should be done at the upstream side of the TDI in point 2.
R. Losito said that there is no way to correct the deformation in situ. A spare TDI (the one removed in 2008) could be reassembled but this would take 3 months plus 3-4 weeks of installation and bake out. The design of the TDI beam screen should be anyhow reviewed.
G. Arduini pointed out that the deformation could have been induced by heating during mis-injection.
R. Schmidt added that FLUKA studies should be rechecked for the Cu beam screen in order to evaluate this hypothesis.

4. Next meeting

Tuesday, 24th January: **LBOC meeting (15:30 in 874-1-011)**.
Thursday, 31st January: **LBOC meeting (15:30 in 874-1-011)**.