Electron cloud meeting #29, 08/04/2015

Participants: G. Arduini, E. Belli, N. Biancacci, B. Bradu, G. Bregliozzi, K. Brodzinski, L. Carver, S. Claudet, G. Ferlin, G. Iadarola, K. Li, L. Mether, E. Métral, G. Rumolo, B. Salvant, M. Schenk, J. Sopousek, M. Taborelli, C. Yin Vallgren.

Matters arising (G. Rumolo)

- This meeting is meant to be the continuation of the e-cloud meeting on 17 March, devoted to the readiness for the LHC scrubbing run in 2016 and the following intensity ramp-up with 25 ns beams.
- Introductory/follow up slides are available here. Some points:
  - Concerning cryogenics (from last meeting and/or last LMC meetings): better feed-forward based on empirical estimation of the e-cloud induced heat load, coefficients will need to be adapted to the 2016 behaviour with 288 bunch injections; all sectors will have the same cryogenic capacity (i.e. 160 W/hc), potentially even more but passing these values may clash with machine availability due to loss of CM in Q6. A question that was raised by G. Iadarola was also about possible gains from reviewing the conditions for CM. S. Claudet said that indeed the conditions can be revisited, if required, but a detailed analysis of is needed.
  - Running a certain number of cells with higher temperature to assess possible temperature effects on the scrubbing efficiency should not cause problems because this will be only done with few cells and at injection energy. The cells can be selected only after first experience with 25 ns beams.
  - Tests will be planned on next Sunday to check available space for low working point, e.g. (.27, .295), as needed space to accommodate the electron cloud tune spreads, and ADT settings with the experts. The status of the implementation of the correction for the tune/chroma decay (M. Solfaroli) and of the tune correction over the injection process to compensate for the Laslett tune shift should also be checked. **To be followed up within the LBOC (Elias).** Another question raised by G. Arduini is also whether the ADT can be used in its large bandwidth mode, as was in 2012 but not in 2015, because this could have been another reason for the better beam stability with 25 ns in 2012 w.r.t. 2015 (we could operate with lower chromaticity in 2012 compared to 2015).
  - TDI consignes and MKI policy to be discussed with/provided by experts (A. Lechner, M. Barnes)

LHC beam vacuum evolution during 2015 machine operation (C. Yin Vallgren)

- Slides are available here.

- The pressure evolution from the vacuum gauges at various positions in the LSSs or in their vicinity was checked and mostly showed signs of scrubbing (decreasing normalized pressures). E.g.
    - The LSS-combination chambers (with two beams and NEG coating), MKI's, cavities. The TDI chamber did not show much conditioning.
    - Average values from gauge readings in LSS3 and LSS7, NEG pilot sector, cold-warm transitions with and without direct incidence of synchrotron radiation all exhibited a conditioning slope.
- A slight slope was also observed in the evolution of the pressure in the experimental areas. Small pressure rises are observed in the experimental areas at injection, ramp and when beams are collided in ATLAS and (especially) CMS. A large pressure rise was observed at injection in CMS when the solenoid was off, due to the electron cloud (although the region is almost completely NEG coated, but probably the two beams with 25 ns still produce electron cloud even with very low SEY). It was suggested to look into the details of the pressure rise at collision for ATLAS and CMS, to check whether it really follows the beams getting into collision or it is delayed (to try disentangling whether it is a real effect or an artifact)
- No much is visible in the arcs. From the few available gauges the pressure pattern between sectors is not the same as the heat load or the beam loss. Conditioning and deconditioning, however, were observed and the pressure evolution in this sense agrees perfectly with what was extrapolated from the heat loads and the beam lifetimes (shown by Gianni e.g. in Evian and Chamonix, based on the reference fills)
- NEG regions are not seen to decondition. One region that was accidentally vented during TS2 showed large pressure rises after returning to operation due to NEG saturation.
- Not much scrubbing was observed at the MKIs and their interconnects (especially that with Q5 that limited injections in 2015). The simulations of the pressure profiles show that actually the pressure in the MKI modules is much larger than that read at the gauges. It was again confirmed that the solenoids in the critical interconnects were checked to be working as from settings.

ADT ObsBox (L. Carver)

- Slides are available here
- Observation Box fed with the ADT position data will be available to detect, record and study instabilities
    - Dedicated buffer at injection is being prepared with full data sets from 32K turns
    - Positions of all bunches are recorded to allow offline analysis (e.g. bunch-by-bunch tunes)
    - Fast download of a subset of bunches is also made possible for on-line monitoring during the scrubbing run

- Last year's data showed some bunch-by-bunch trends in the tunes, but data were mainly available only in the advanced phase of the scrubbing.
- Interpretation of tunes at injection is not straightforward, injected beam behaves differently from the circulating beam and the feedback action causes notches at the tune positions (instead of peaks). This needs to be followed up as data become available this year.

Heat load from impedance and synchrotron radiation (B. Salvant)

- Slides are available here
- The new variables giving the heat load from impedance and synchrotron radiation have been implemented in Timber and can be used also for the past fills.
- For example, applying the calculation to the 50 ns run in 2015 and plotting the new variables together with those of the heat load sector by sector, we can see that the calculation fits very well with the measured heat load in the arcs for all the fills.
- If we do the same for a 25 ns fill, we see a gap between the values, where the difference is obviously the heat load coming from the electron cloud.
- Also in the case of 8b+4e run, which was electron cloud free, the calculated heat load is found completely consistent with the measured one.
- It would be interesting to run a check on the difference between the average heat load over all the sectors and the expected heat load from impedance + synchrotron radiation, and when this value exceeds a certain threshold value (which we can define based on the expected error) a 'WARNING: ELECTRON CLOUD' is issued.
- Problems with Fixed Display are presently being addressed by BE-CO

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- Readiness of 25 ns beam in the SPS (H. Bartosik): The nominal 25 ns beam (1.2e11 p/b with emittances below 3 um) has been accelerated to 450 GeV and used for HighRadMat. However, much more work is still needed to have the complete set up for extraction to LHC. In particular:
    - Setting up of LHC 25 ns cycle with 4 batch injection, which was not used last year
    - Optimization of 800 MHz settings (new low level RF)
    - Transverse damper optimization
    - MKP waveform alignment and verification of 225 ns batch spacing to be done
    - Verification of new MKE4 kicker system settings (length of waveform, delay)
    - Hopefully not much delay will be accumulated due to the ZS opening.

Adjournment

Next electron cloud meeting will be taking place just before the scrubbing run to again check that all the tools and prerequisites are in place to begin the scrubbing.

GR & GI, 13/04/2016