LHC e-cloud simulations Meeting – Draft Minutes

Date: 29 March 2012
Meeting Room: 112-C-17

Attendees: Octavio Domínguez (OD), Humberto Maury (HM), and Frank Zimmermann (FZ).

Excused: Gianluigi Arduini (GA), Chandra Bhat (CB), Giovanni Iadarola (GI), Elias Métral (EM) and Giovanni Rumolo (GR)

Agenda

1. Minutes and actions from the last meeting
2. Update on e-cloud simulations, **Humberto Maury**
3. Update on e-cloud map studies for scrubbing optimization, **Octavio Dominguez**
4. AOB

Outstanding actions from the last meeting

Actions from the last meeting on 15 February:

- Sensitivity of map coefficients with simulation pressure (OD) – This will be presented later today.
- Check the e-cloud at 25 ns in the SPS with the nominal scheme (4x72 bunches) and with an alternative scheme with 5x48 bunches (OD) – Similar studies were done for the LHC and will be shown in the following.
- Presentation of measured bunch-length effect on arc heat load (CB) – Next time?
- Repeat simulation for flat bunch at the same rms length of 7.55 cm (HM) – Planned.
- Develop HEADTAIL-PTC or HEADTAIL-MAD-X simulation (HT working group) – No news.
- Explore if R=0.5 would really be inconsistent with a “reasonable” value of δ_{max} (GI) – No news.

Update on e-cloud simulations

Humberto Maury had performed PyECLOUD simulations for the dependence of the multipacting threshold on the pipe radius and compared with the corresponding simulations from ECLOUD. Simulations are done for 3.5 TeV energy, with photoelectrons as primary seed. A parameter list was shown (same parameters have been used in both codes). Some agreement and small differences in the multipacting threshold are observed.

The biggest difference is found for a chamber radius of around 100 mm, where the threshold from ECLOUD is 1.9 and from PyECLOUD 1.7.

The way the threshold is inferred in a qualitative way was explained, roughly when the end of the second train has a higher value than the end of the first train.

Peak ECLOUD e- densities are an order of magnitude higher than for PyECLOUD (1e11 versus 1e10/m) for large secondary emission yields.

The time-averaged e- density for ECLOUD is lower than for PyECLOUD at lower secondary emission yield, and higher at higher yield. Plotted on linear scale it shows a remarkable difference, and also indicates another way to define the threshold (attending to a sudden change in the slope of the curve average density vs. SEY). The number of batches used in the average was 4 for PyECLOUD and 2 for ECLOUD. This calculation could be repeated for the same number of batches or even better would be to redo the comparison with a long train and without any gap (**ACTION**→HM). Also heat load and central density should be compared in addition to the total density in order to understand better this difference (**ACTION** → HM).

Two multipacting thresholds can be defined – one for overall growth including gaps between trains and one for growth inside the train.

Some simulation results with a varying radius for 25 ns were presented as well. Simulations for 25 ns should be completed and also be done with ECLOUD for comparison (**ACTION** → HM).

Update on e-cloud map studies for scrubbing optimization

Octavio Dominguez started with some brief considerations, including actions and other comments from the last meeting.

Last time, fits for the first and second empty bunch were shown, inferred from different intensities. There was the question about why different bunch intensities would yield to obtain these maps. OD showed a plot where 30 parameter sets (varying N_b, SEY, e_{max} and R) were superimposed showing three clusters, which indicates that the decay maps are universal, i.e. equal for any parameter set. Nevertheless, the map 11 is particular for every parameter set and the map 01 must be calculated using a same parameter set varying only N_b.

Difference between having one (as in previous studies by U. Iriso or T. Demma) and two maps for the decay is due to the time interval chosen for defining the maps. Performance seems to be almost equivalent although the agreement with simulations is slightly better for two separate maps 110 and 100. The worst disagreement between the maps and simulations is in the first full bunch after a gap.

Next the influence of the input initial pressure used for the map construction was examined. The results are similar with maps obtained at an initial pressure varying by a factor of 100. FZ observed that the maps constructed from 200 nTorr gave results which were more different from PyECLOUD simulation at 200 nTorr than those with maps constructed at 20 nTorr and 2000 nTorr. The assignment could be verified (Possible **ACTION** → OD).

Scrubbing optimization was presented for the location of the gauges, with different single, double and triple batches, with various choices of missing PS bunches. All the schemes with missing PS bunches yield similar results, although there are relevant differences according to the different parameters sets. The triple batch schemes look very attractive with a higher integrated flux even than repeating 72-bunch trains without gap, and possibly at higher stability since the peak flux is lower and/or is reached less times during one turn (13 vs. 32). The gain and relative flux depends on δ_{max}.

Similar simulations were presented for the arcs with analogue results. The case with “green” triple batch scheme (i.e. ((36b + 12e + 24b + 225ns)x3 + 925 ns) x13) looks the best with regard to instability. The effect of varying ε_{max} was also illustrated.

In conclusion, one can observe that different parameter sets (i.e. status of the machine) yield different preferred schemes. From the cases studied the scheme ((36b + 12e + 24b + 225ns)x3 + 925 ns) x13 could lead to a better performance in terms of higher dose and better stability, for all situations considered. More schemes will be examined.

AOB

A talk on simulations for the ALICE 800 mm common pipe by GI was postponed to the next meeting, which will be announced in due time.

Reported by Octavio Dominguez and Frank Zimmermann