Minutes of 69th Collimation Upgrade Specification Meeting

Participants: R. Bruce (RB), M. Fiascaris (MF) (scientific secretary), W. Hofle (WH), A. Mereghetti (AM), D. Mirarchi (DM), S. Redaelli (SR) (chairman), R. Rossi (RR), A. Valloni (AV), Remote: H. Garcia Morales (HG).

Indico event [here](#).

1 Actions

Actions from this meeting for the IPAC paper on active halo control:

- JW to express the ADT amplitude in terms of beam $\sigma$.
- HG to revise the implementation of the frequency scan in simulations to mimic more accurately the hardware.
- HG, RB to extend in the future the model to 4D.

2 Review of measurements from halo control MD (J. Wagner) [slides](#)

2.1 Summary of the presentation

JW summarised the results from the MDs for halo control using the ADT, in view of the preparation of a paper for IPAC.

JW explained how, during the MD, three bunches were used: one reference bunch outside the ADT excitation window and two bunches inside the active ADT window. Out of these latter two, one bunch was blown-up to increase the beam tail population, while the other was used as a witness bunch to check the effect of the ADT excitation on the beam core. The ADT excitation was then applied on nominal bunches either in a frequency sweep or at a fixed frequency in the horizontal tune space $Q_x$. The frequency sweeps were performed in steps of $\Delta Q = 10^{-4}$, each for $\Delta t = 1$ or 2 s.

JW emphasized the selection of results that will be included in the IPAC paper. The list includes: results of de-tuning with amplitude, beam intensity and emittance evolution during an ADT frequency scan, beam intensity and emittance during the fixed-frequency excitation.

During the frequency scans, the ADT amplitude was 0.03 and the tune was varied inward or outward in the range $[0.285, 0.295]$. The obtained bunch intensities and emittances showed that the reference bunch was not affected during the whole scan, while the blown-up bunch experienced scraping of particles earlier than the witness bunch. An ADT excitation with fixed frequency at $Q_x = 0.295$ was then applied for 120 s. JW showed that while the blown-up bunch intensity decreased by about 2%, witness and reference bunch were unaffected.
2.2 Discussion
RB pointed out that it would be useful to express the ADT amplitude of 0.03 in terms of beam $\sigma$. SR commented that in the paper one should justify the choice of $Q_x$ for the fixed frequency excitation. Finally, SR concluded that, although good results were achieved during the MD, the studies are not conclusive yet. In order to assess the feasibility of this method, we should be able to reproduce the results and stay in the excitation for a longer time.

3 Simulations of narrow band excitation

(H. Garcia Morales) [slides]

3.1 Summary of the presentation
HG presented simulations for narrow-band excitation with the ADT. He developed a simple model to test the principle of the narrow-band excitation. The model consists of a map which includes the octupolar contribution plus the ADT kick in the P coordinate. The octupole strength was derived matching the model to results of de-tuning measurements.

HG showed simulation results for fixed frequency and frequency scans. At fixed frequency, a value of $Q_x = 0.295$ was used, as in the MDs. A comparison between initial and final amplitude distributions showed that the excited amplitude was affected, while the core was not. However the intensity decrease was modest and the emittance was unchanged. The effect of the excitation was more visible for simulation results for frequency scans in the range $Q_x = [0.290, 0.295]$. The tail beyond $4 \sigma$ was clearly depleted. However, it was also observed that part of the tail population remained and the core was also partly affected. The bunch intensity was reduced by about 1.8% and, while the emittance of the full bunch was found to increase, that of the core was unchanged.

In conclusion, HG showed that the toy model gives promising results, although simulations for fixed frequency are not conclusive. In the future, full simulations with tracking code are planned to have a more precise description of the narrow-band excitation, including also non-linear effects.

3.2 Discussion
SR commented on the limitations of the model: the fact that chromaticity is not accounted for is based on the assumption that there was no chromaticity during the measurement, which should be checked. Furthermore, although non-linear effect are not accounted for, the model was matched to fit the measured non-linearities.

RB commented that for the intensity plots, one should remove the particles that have already crossed the $5 \sigma$ amplitude, to avoid recounting them.

It was pointed out that no effect should be seen on the core if the ADT is ramped down adiabatically. HG confirmed that this feature is included in the model and more investigations are needed to understand why the simulation results show some effect also on the core.

There was some discussion with WH on the way the ADT frequency was changed for the scan. HG explained that in the simulations only the frequency $Q_x$ was changed. It was suggested to include an additional phase, since the hardware in reality performs a continuous
integration. This could explain the observed effect on the core and should be revised for IPAC.

Finally, it was suggested to extend the model to 4D. It was agreed that this could be done in a longer time scale (beyond IPAC), since some careful thinking about coupling elements would be needed.