

Electron cloud studies (MD6923 + MD6845)

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Disclaimer: These MD requests are all to be done at **injection energy**

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MD6923: Slow beam degradation from incoherent electron cloud effects on the 3Qy resonance

Procedure:

Ideally, the optics measurement setup will be inherited from MD9549 if it is right before in the schedule.

Part I (non-linear optics measurements with Pilots)

1. Standard setup for optics measurements: mask BLM, kickers, ac-dipole keys, collimators, ATLAS BCM (**will need to be reverted for second part of MD**)
2. Perform small and large amplitude kick with AC-dipole up to amplitude limited by BLM thresholds, to obtain measurements of 3Qy RDT
3. Test past corrections for 3Qy resonance using MCSSX. Trims of these circuits will be varied to attempt to minimize the 3Qy RDT. Kicks performed in between trims to check corrections.
4. MCSSX may be varied up to their maximum powering depending on observed RDT.
5. Once a correction has been found - we measure the beta-beat and coupling induced by the correction when applying it to 20%/40%/60%/80%/100% of its strength.
6. Beta-beat, coupling and the 3Qy RDT will also be measured when the "phase knob" is set to 0.

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Procedure:

Part II (high intensity)

0. Revert configuration (masks, collimators, e.t.c.) to nominal operation

For each fill:

1. Trim the MCSSX to (partially/fully) correct the 3Qy resonance. OR Trim the "phase knob" to 0 (2022 configuration).
2. Inject probe.
3. Correct linear coupling, chromaticity and tunes.
4. Inject 12 bunches and the train(s) of bunches. (3x27b, 1.4e11p/b)
5. Optionally, retract TDIS to minimize losses on it.
6. Trim vertical tune from 60.293 -> 60.35 in multiple steps or in one slow step.
7. Repeat with a different correction of the 3Qy/powering of the MCSSX (or value of the "phase knob").

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rMPP Questions/Comments:

- “Clarify max. number of bunches (3x72b or 600b)”
(12b + 3x72b) = 228b per beam = 456 bunches in LHC. [Modified MD request.](#)
- Clarify “Optionally, retract TDIS to minimize losses on it”.
After all bunches have been injected, we can retract the TDIS to avoid unnecessary losses on it. (After the bunches are injected, we expect to lose a sizeable fraction of the beam slowly while approaching the resonance.)
- “Put explicitly the optics collimator sequence to be used”
Collimator sequence *should* be “LOAD COARSE SETTINGS FOR NLO”. We are waiting confirmation on the exact name with the OP team and we will include it as soon as possible.
- “Max. allowed beta beat?”
The usage of the skew sextupole correctors in the Inner Triplets (MCSSX) correctors will inevitably induce some β -beating because of feed-down effects from the crossing scheme. During the MD we will measure the induced beta-beating and we will limit our powering of the MCSSX such that β -beating < 20%. **Is this enough or should we limit the β -beating to smaller values?**

MD6845: Instability measurements with varying bunch intensity

Procedure:

For each fill, starting at intensity 1.8×10^{11} protons per bunch (staying at 450 GeV), we follow the procedure:

- a. Inject probe.
- b. Correct coupling, chromaticity and tunes.
- c. Set octupole current and chromaticity setting to desired values.
- d. Inject 12 bunches. Inject 72 bunches multiple times.
- e. Slowly lower octupole current until there is activity in the ADTObsbox.
- f. Revert octupole current to a high value.
- g. Do steps (e-f) for several different settings of chromaticity.
- h. Dump when the beam is too spoiled and make a new fill with different intensity ($< 1.8 \times 10^{11}$ p/b) to continue with measurements.

rMPP Questions/Comments:

- “Clarify max. number of bunches (450 or 600?)”
($12b + 72b + 72b + 72b + 72b$) = 300b per beam = 600 bunches in LHC. **Modified MD request to mention maximum 300b per beam instead of “~450b”.**
- Discussion of required bunch intensities above the operationally achieved value (up to 1.8×10^{11})