



CM05 Magnetic Separation Center Non Conformity

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Magnetic Center Separation Requirement

Requirement LMQXFA-R-T-06: The distance between the two nodal points of the MQXFA magnetic lengths is $4806 \text{ mm} \pm 5 \text{ mm}$ at room temperature (296 K).

- We have decided that this requirement needs a modification since during CA01 assembly we have observed that the measured Magnetic Center Separation (MCS) of the two magnets at room temperature was different:
 - It was 4792 mm (14 mm shorter)
- Ezio contacted CERN's accelerator experts and according to them this is not an issue since the beam optics can be adjusted
- We have created an NCR and we have decided that we will wait to have a few more CMs built and measured before we will pick the new target value for the MCS (Ezio's request) and then we will update the FRS and the acceptance criteria

-----Original Message-----

From: Riccardo De Maria <Riccardo.De.Maria@cern.ch>

Sent: Wednesday, March 10, 2021 1:09 AM

To: Sandor Feher <fehers@fnal.gov>; Elias Metral <Elias.Metral@cern.ch>; Rogelio Tomas Garcia <rogelio.tomas@cern.ch>; Ezio Todesco <Ezio.Todesco@cern.ch>; Susana Izquierdo Bermudez <susana.izquierdo.bermudez@cern.ch>; Giorgio Ambrosio <giorgioa@fnal.gov>

Subject: RE: Sandor Feher's Zoom Meeting

Hello,

I updated the model. When uncompensated, the change in position of the halves of Q1 and Q3 cause a 7% beta* error. The optics was easily re-matched (still needing 7 steps due to the non-linear response of the quadrupole strengths) to restore the main features. The cost was only very small (the 3-4 units) increase in Q2/Q3 strengths for which there are margins and comparable variation in all nearby quadrupoles. The other figures of merit were kept basically constant.

This shows how sensitive is the optics to the model and that there is enough flexibility on small changes of design parameters. Again the priority should be reproducible features and accurate magnetic measurements. Updating the model on paper is easy, but with beam measurements 7 iterations may be prohibitive.

In conclusion we confirm that the change is acceptable.

Ezio, will you inform Oliver and TCC?

Best,
Riccardo



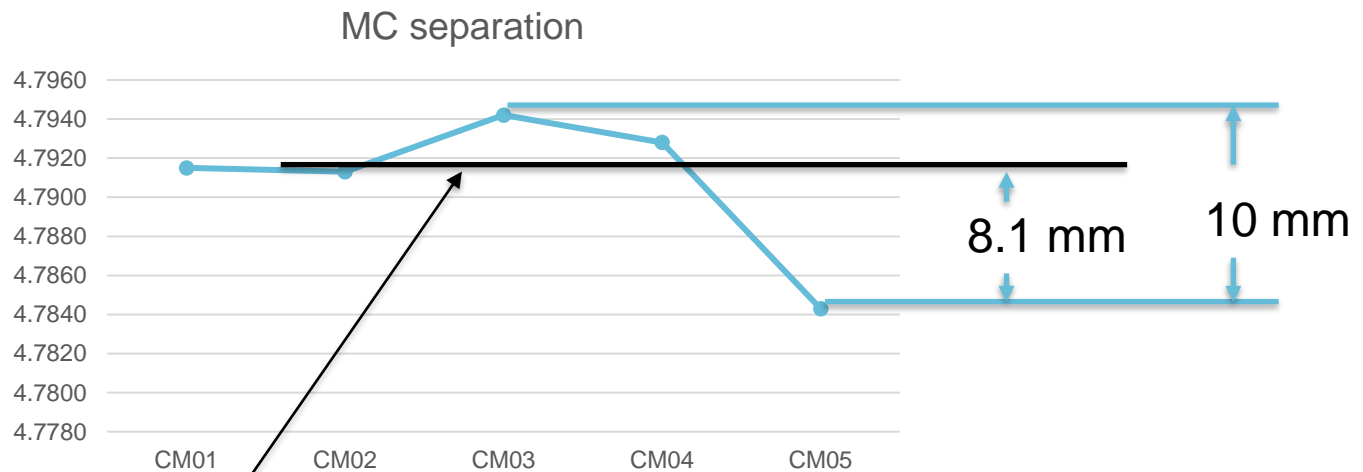
Magnetic Center Separation Measurements

Magnetic Center Separation (MCS) for 5 CMs have been measured so far

- The average separation of the magnetic centers for the first 4 CMs is 4.792
- CM05 magnetic center separation is 8.1 mm shorter than the average for 4 CMs

Measured distances between magnets of each cold mass

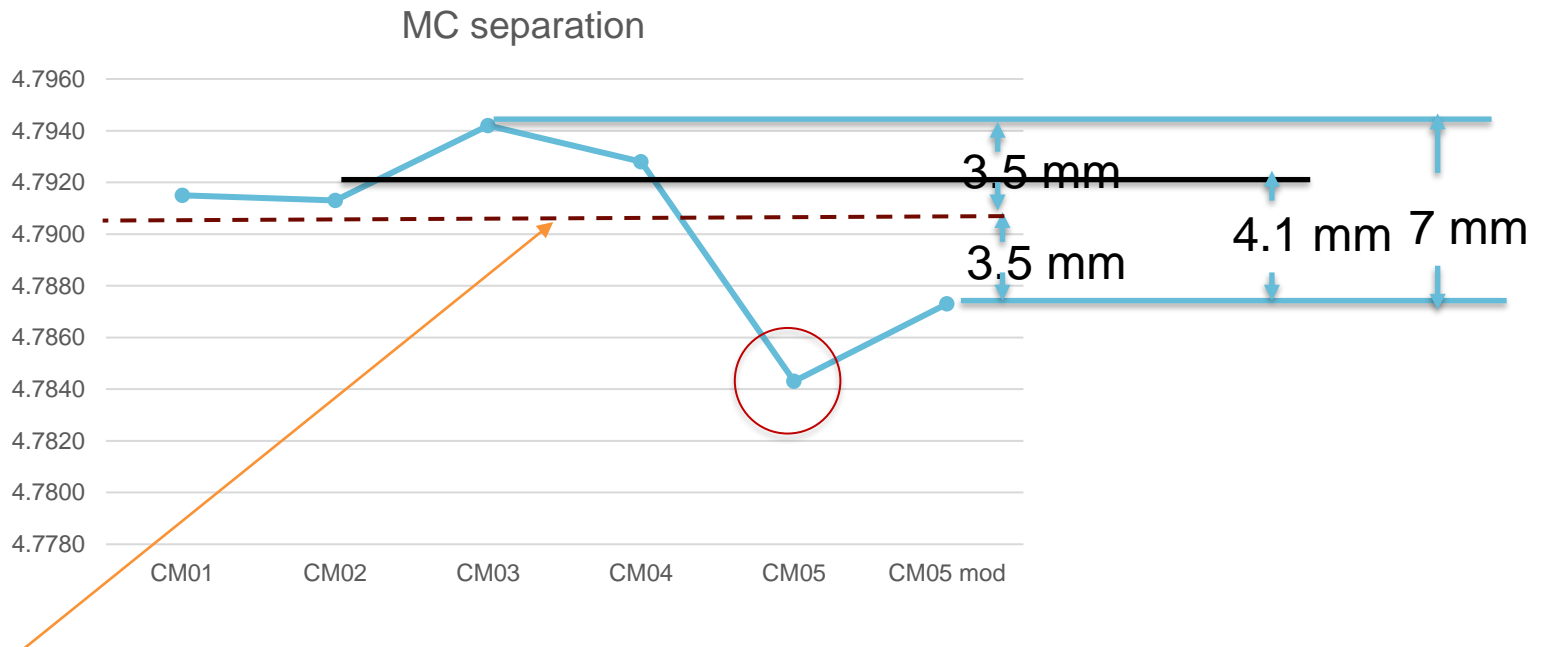
	initial (no shell)	before weld (shell tacked)	after weld	cold (rotatingCoil)
CM01	4.7915	4.7898	4.7895	4.7721
CM02	4.7913	4.7947	4.7930	
CM03	4.7942	4.7934	4.7932	
CM04	4.7928			
CM05	4.7843			



Average for the first 4 CMs

MCS adjustment

- There is a possibility to move CM05 magnets further apart by 3 mm



With the new target MCS value the CMS values for all magnets would be within ± 5 mm

MQXFA16

- It turns out that MCS for MQXFA16 is 6 mm longer
- Adjusting the distance by 3 mm at FNAL means that the tolerance will be within the requirement using the new target value for MCS
- Even if would use for the target value of MCS the average value of the 6 CMs we would be within the ± 5 mm tolerance values (+ 2.4 mm – 4.5 mm)

