



Technical Meeting on MQXFB07: Assembly Observables

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on behalf of MQXF team



11/09/2024

[Technical Meeting MQXFB07 Assembly \(September 11, 2024\) · Indico \(cern.ch\)](https://cern.ch/indico/event/11092024)

Outline

- Yoke shell sub-assembly
 - Vertical sub-assembly (yoke-shell modules)
 - Horizontal sub-assembly
- Coil pack sub-assembly
 - Radial coil pack size
 - Pole-key gap
 - Coil pack squareness
 - Magnetic measurements after coil pack insertion

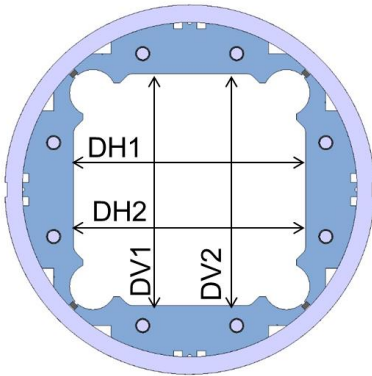
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Completed

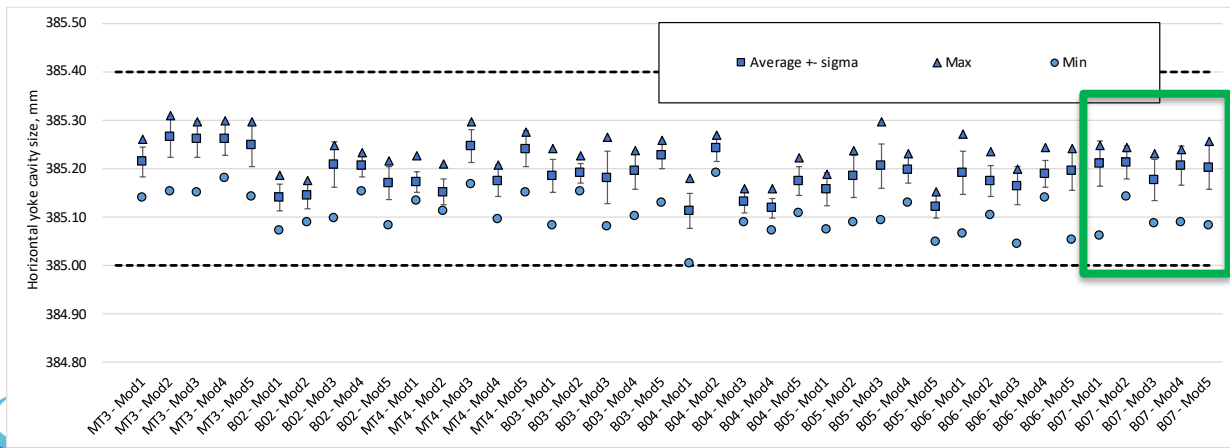
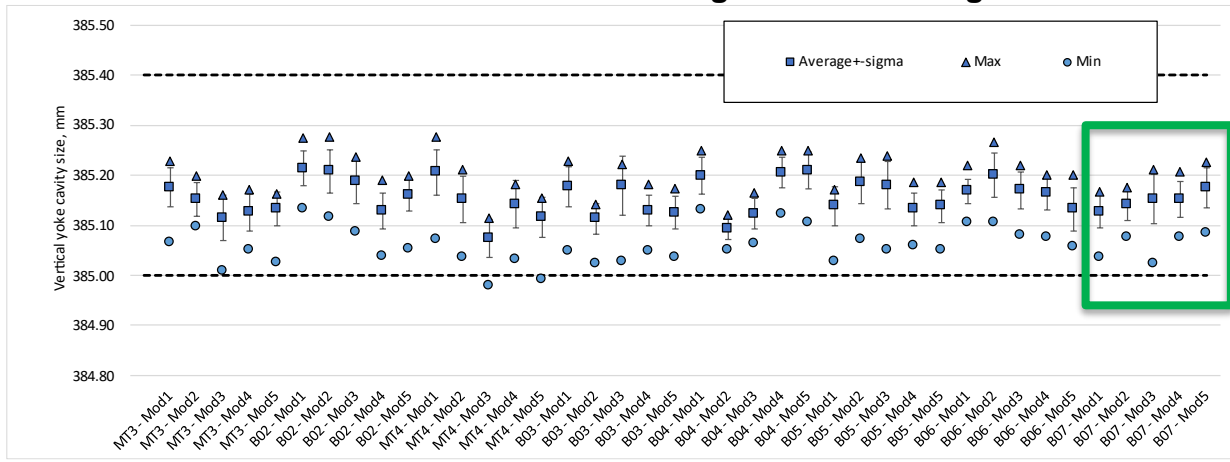
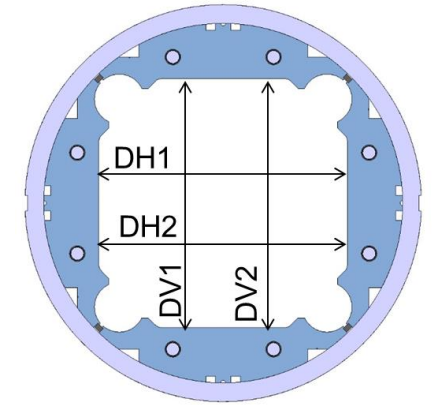
Yoke-shell modules

- Monitored parameters:
 - Shell strain
 - Bladder pressure
 - Yoke cavity size, defined as the average of the horizontal ($DH1 + DH2$)/2 or the vertical ($DV1 + DV2$)/2 dimensions
 - Yoke uniformity, defined as the average of the vertical or horizontal cavity dimension in each cross-section with respect to the measured average vertical or horizontal dimension of the entire yoke shell module
 - Yoke squareness, defined as the difference between the left and right ($DV1 - DV2$) or top and bottom ($DH1 - DH2$) dimensions

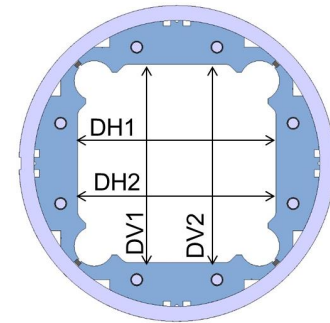


Yoke cavity size (vertical sub-assembly)

- Yoke cavity size within targets
 - The average vertical and horizontal yoke cavity dimensions at each cross-section shall be within $+385.125 -0.125/+0.275$ mm along the module length.



Yoke cavity size (vertical sub-assembly)

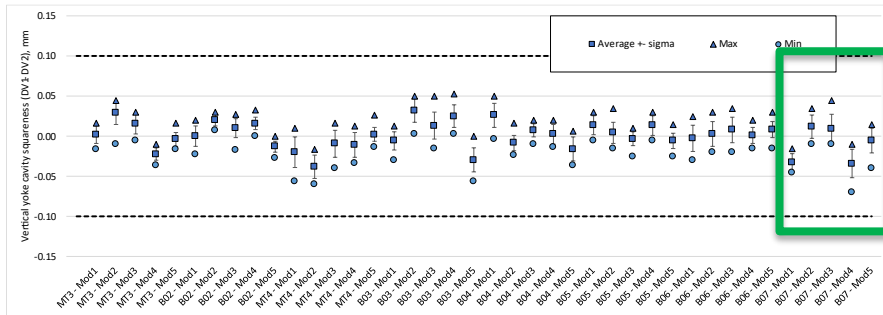


Squareness and uniformity

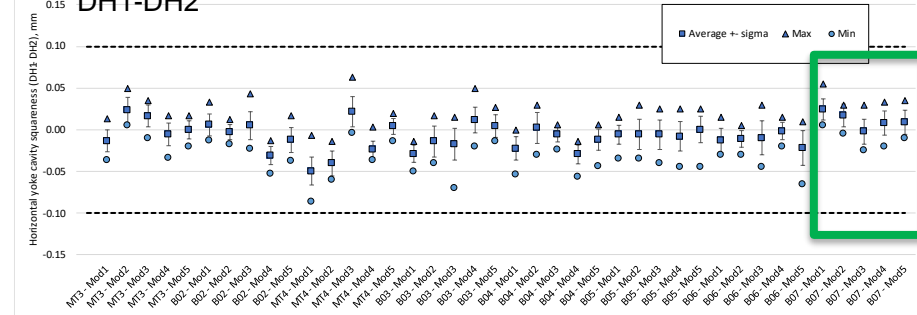
- The average vertical and horizontal uniformity at each cross-section shall be within $-0.15/+0.15$ mm.
- The average vertical and horizontal squareness at each cross-section shall be within $-0.10/+0.10$ mm.

Squareness

DV1-DV2

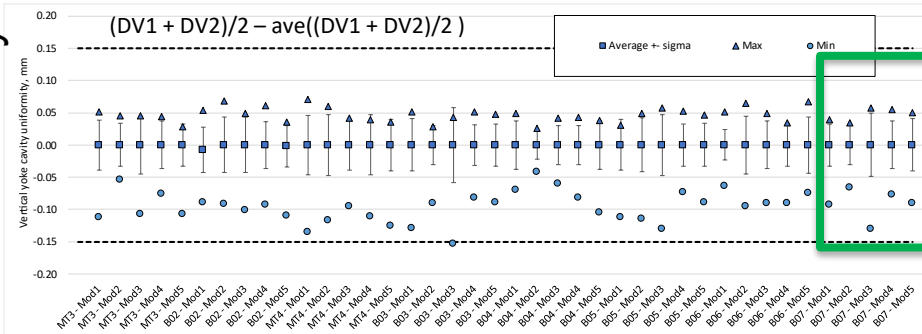


DH1-DH2

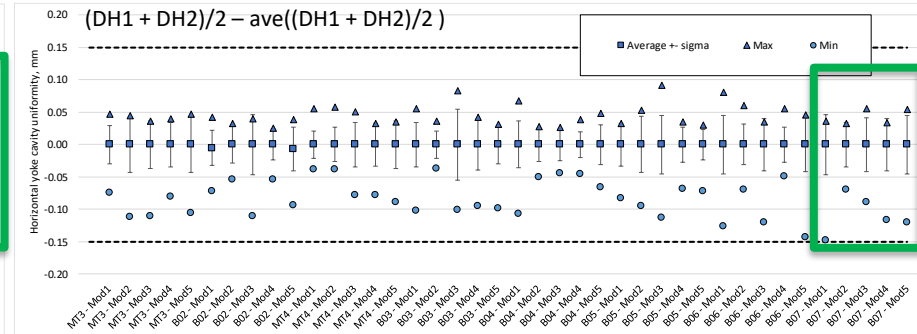


Uniformity

$(DV1 + DV2)/2 - \text{ave}((DV1 + DV2)/2)$

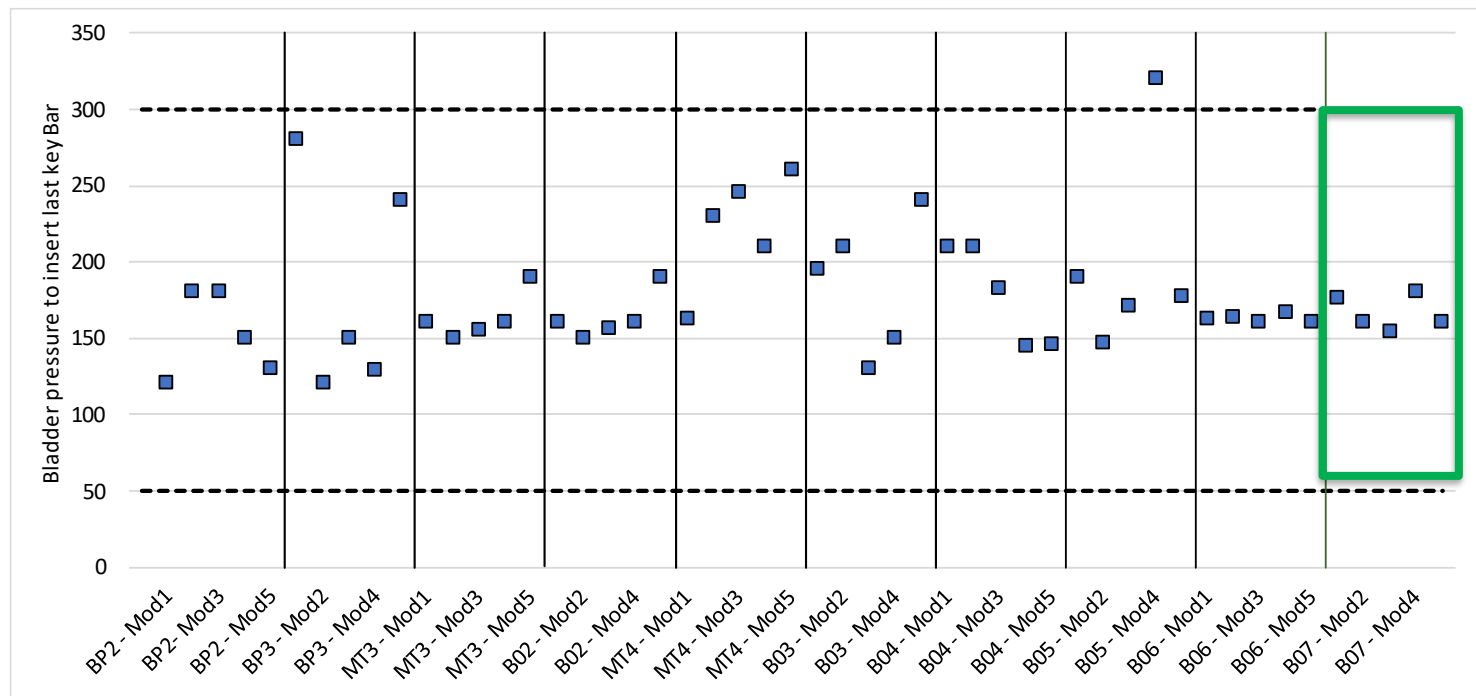


$(DH1 + DH2)/2 - \text{ave}((DH1 + DH2)/2)$



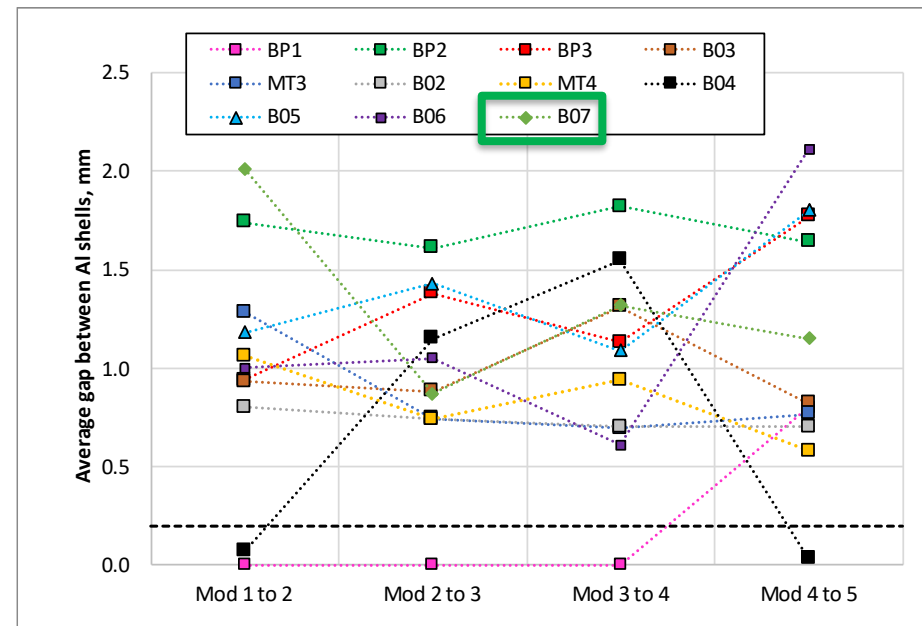
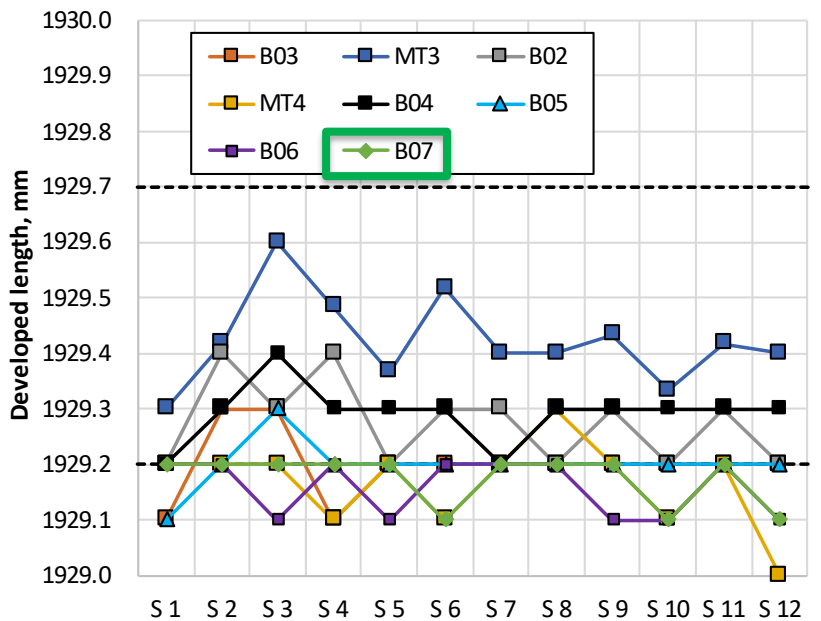
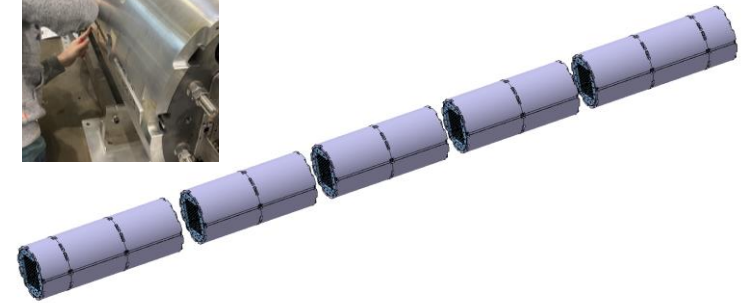
Vertical yoke-shell sub-assembly

- Strain and bladder pressure within targets
 - Yoke keys were 12.1 mm thick in all the cases below



Horizontal yoke-shell assembly

- The average developed length in the middle of each shell shall be 1929.4 -0.2/+0.3 mm.**
 - The developed length in relax state is 1928.9^{-0/+0.3} mm and the increase of circumference for 12.1 mm yoke key is 0.4 mm.
- The minimum average gap between aluminium shells of adjacent modules shall be 0.2 mm**
- Yoke cavity is measured again once the modules are assembled, and shall be consistent with the vertical yoke-shell subassembly measurements
- The total length of the structure shall be 7521 ± 5 mm



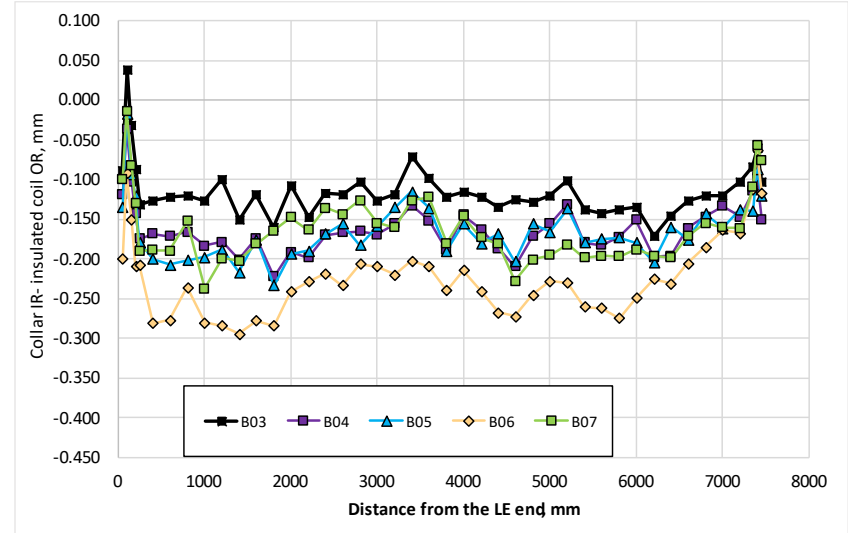
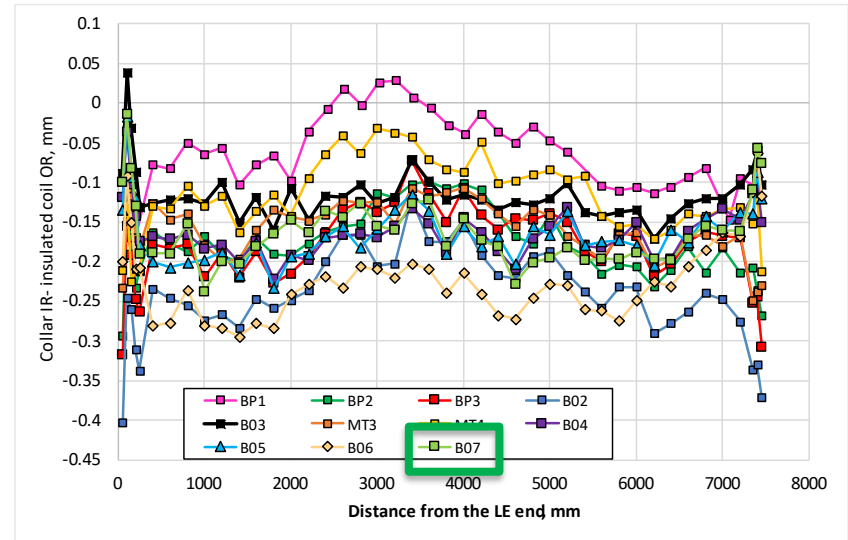
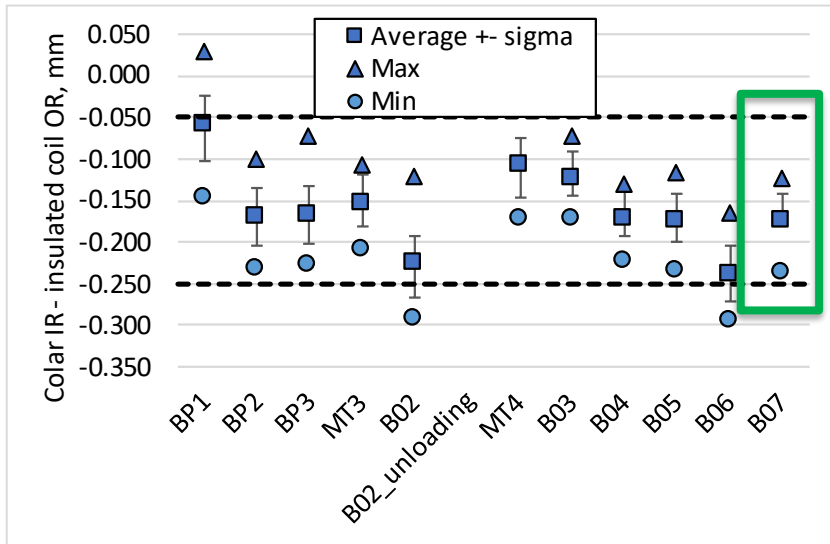
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- **Coil pack sub-assembly**
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Completed

Coil pack radial size

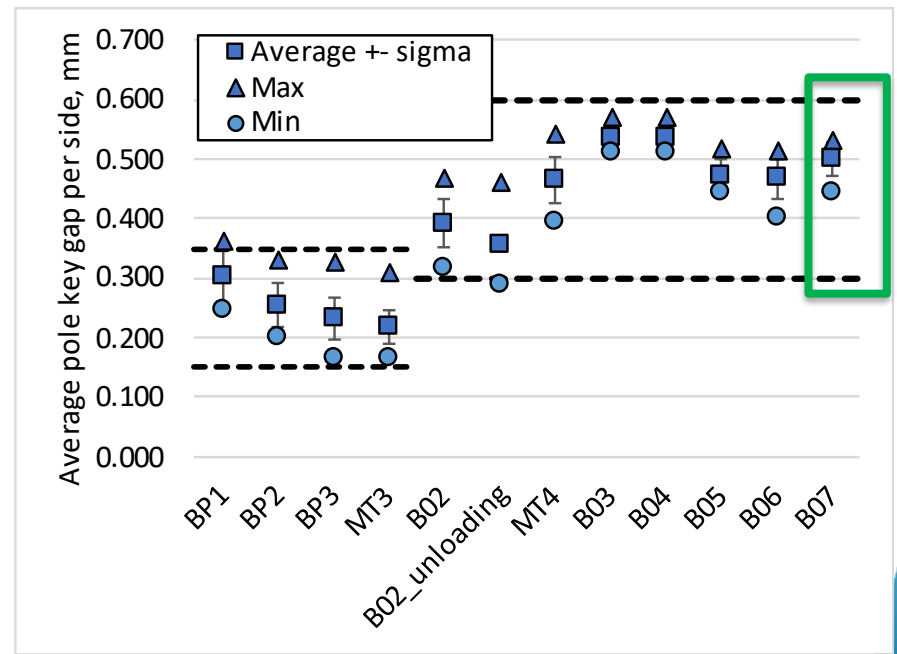
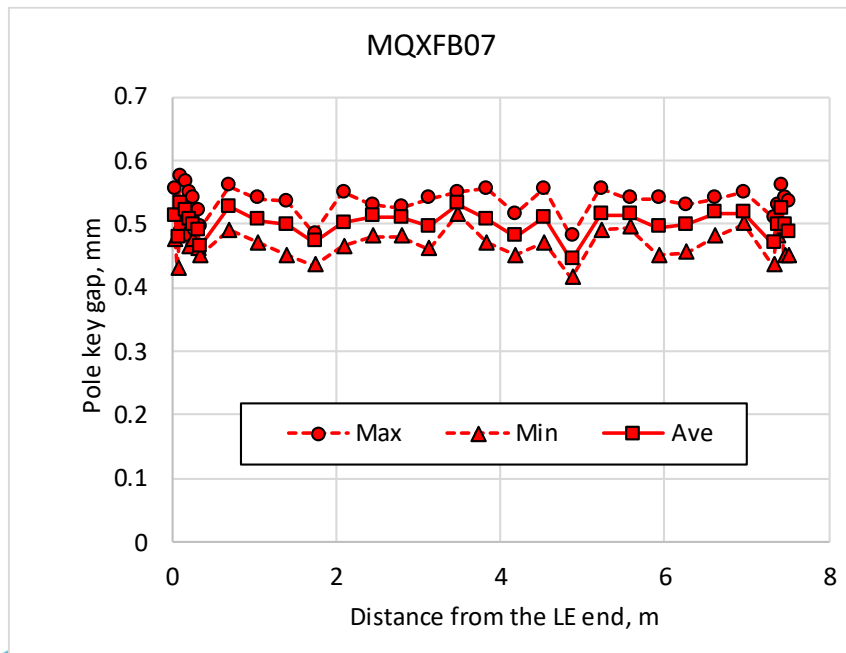
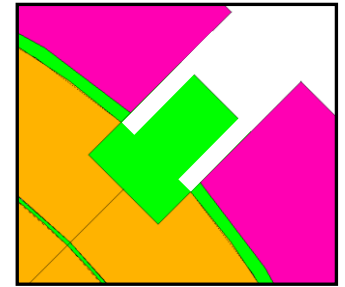
- The gap between collars and insulated coils with respect to the nominal dimension, considering for each z location the average among the four coils, shall be $-0.125 \text{ mm} - 0.125 / +0.075 \text{ mm}$.



The coil pack size is really similar for all the magnets with the 'new generation' coils. B06 size is smaller on purpose, to have a conservative size of the ends, similar to the previous magnets.

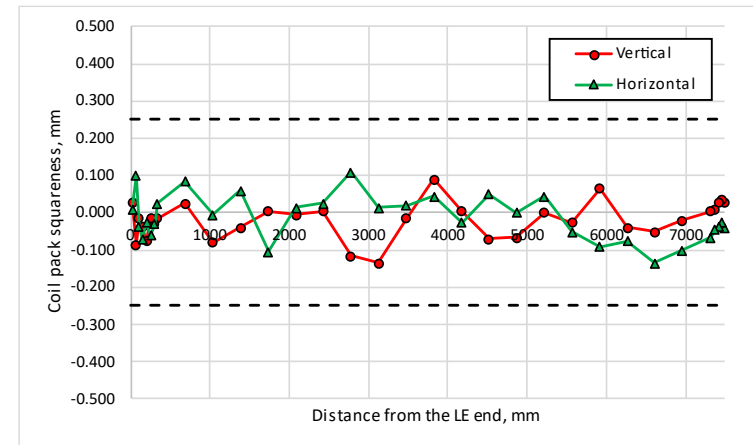
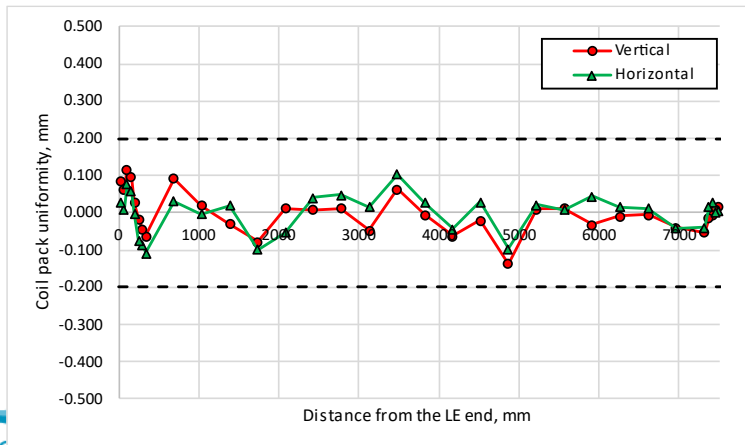
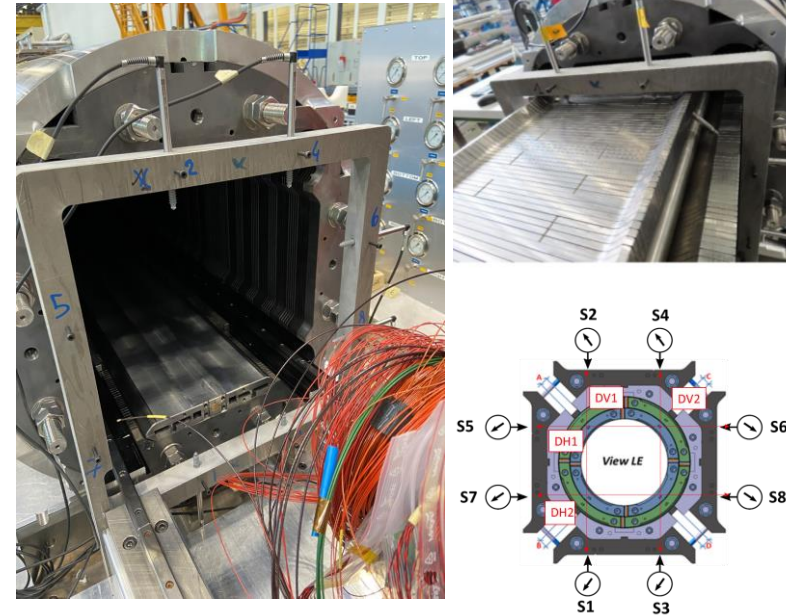
Pole-key gap

- The average pole key gap (per side) along the magnet length shall be $+0.400 \pm 0.100$ mm in each quadrant.
- The minimum pole key gap (per side) in any quadrant and in any longitudinal location shall be $> +0.300$ mm.
 - From MQXFB02, pole keys are machined removing $250 \mu\text{m}$ on each side from the original key (lessons learnt from A07&A08)
 - We have a more uniform pole key gap along the length than in previous assemblies (no coil belly)



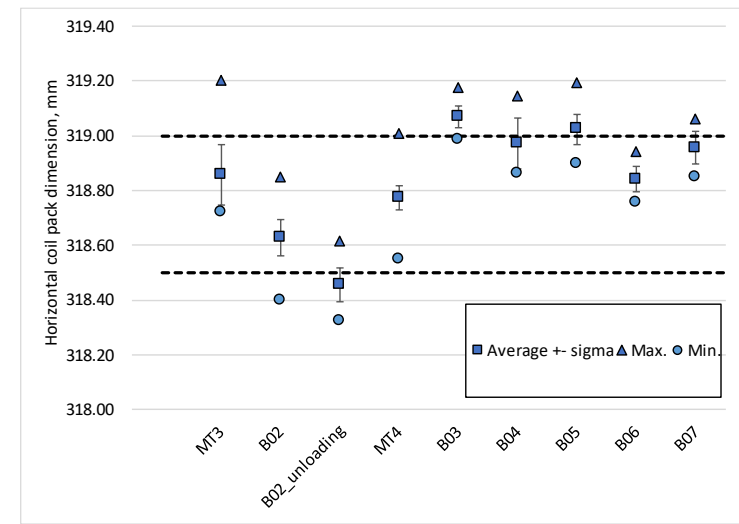
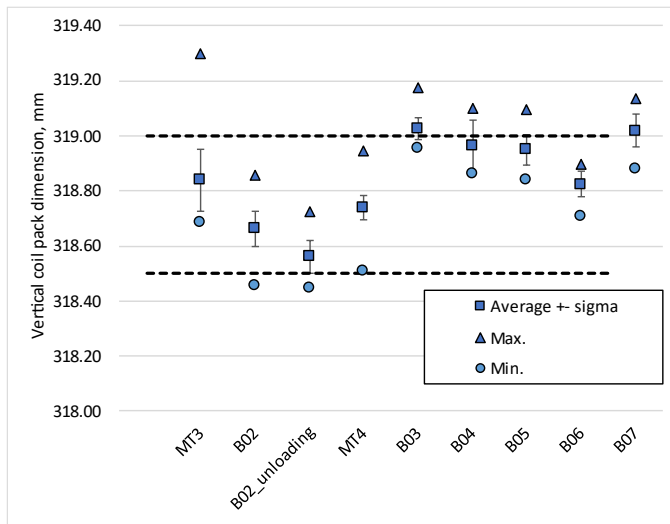
Coil pack geometrical measurements

- For the coil-pack size, uniformity, and squareness the following ranges are set:
 - The average vertical and horizontal dimension of the coil pack along the z axis shall be within 318.75 mm \pm 0.250 mm
 - The uniformity of the vertical and horizontal dimensions along the z axis shall be within \pm 0.200 mm
 - The squareness of the vertical and horizontal dimensions along the z axis shall be within \pm 0.250 mm

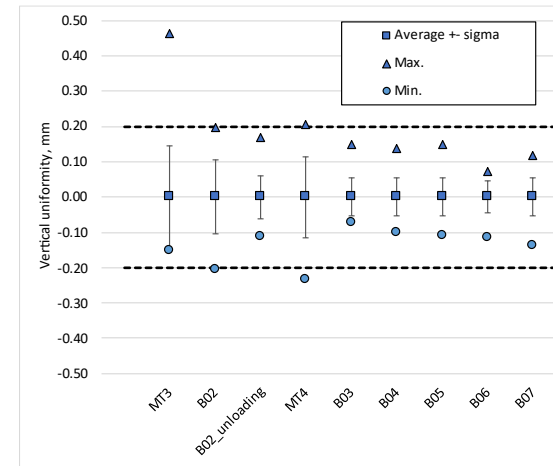
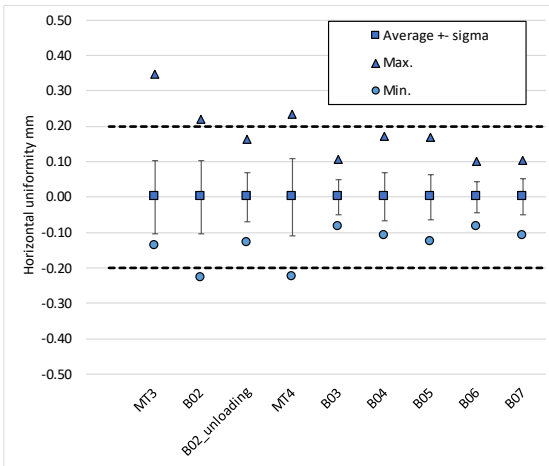
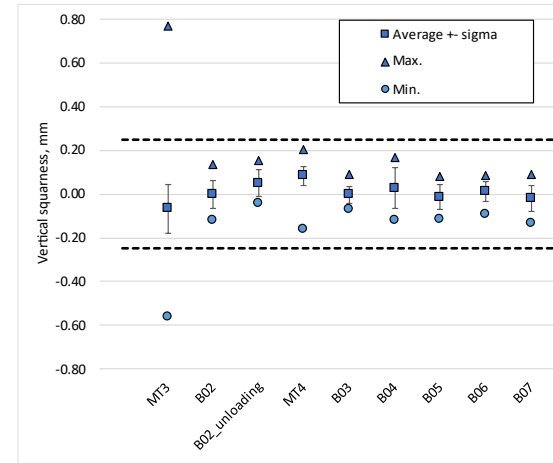
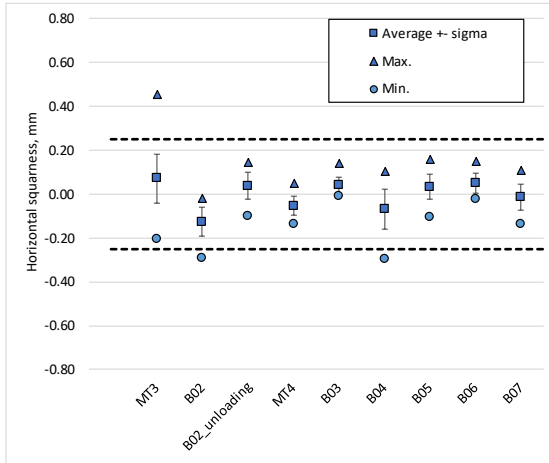


Coilpack external measurements Comparison

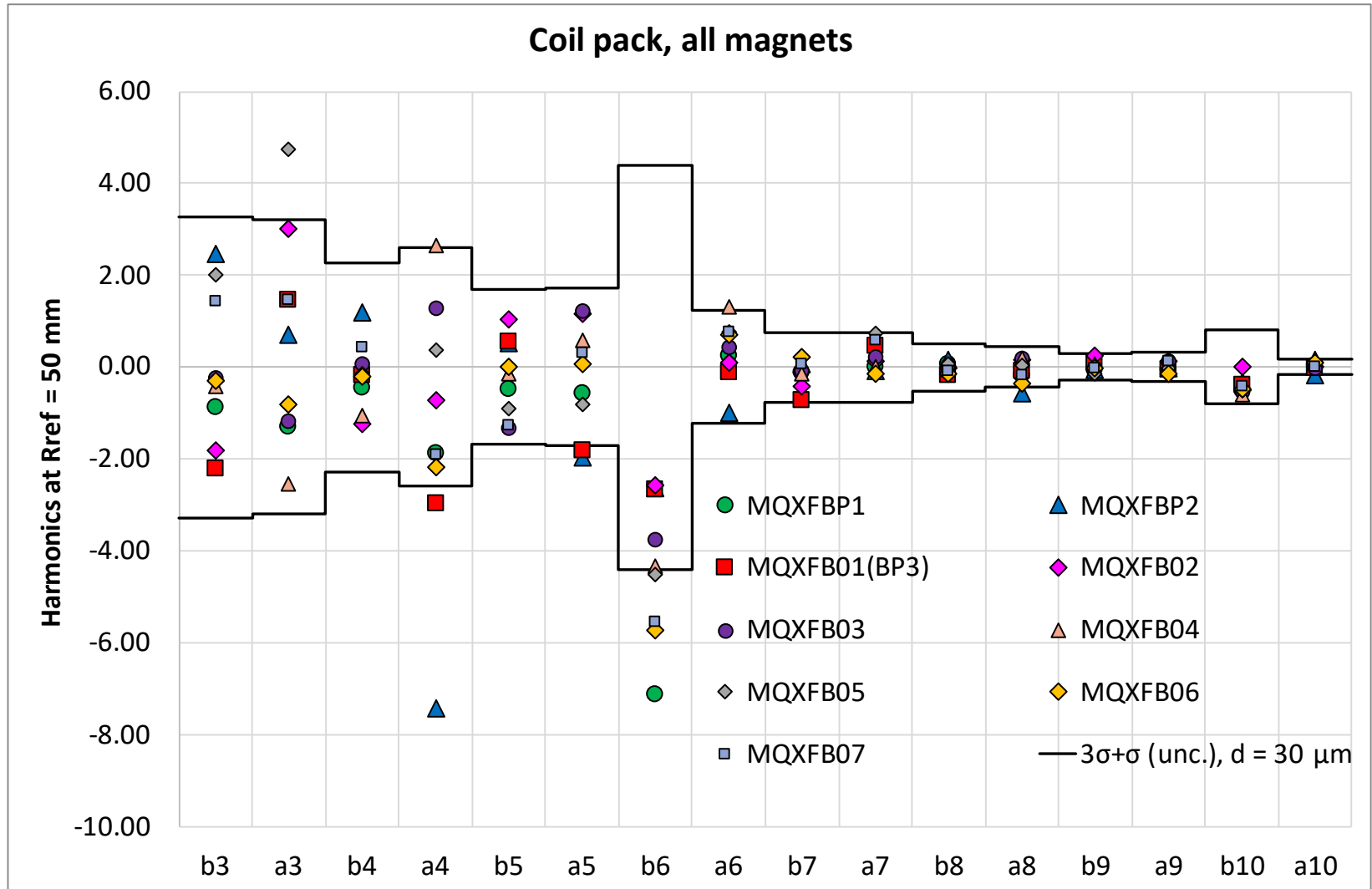
B07 dimensions are similar to B04/B05 as prevued by the shimming plan, both for horizontal and vertical dimension.



Coilpack external measurements Comparison



Magnetic measurements after coil pack insertion



Thank you!