WP3 field quality update


8 December 2020, WP2 meeting
D2 CORRECTOR

- Recap of naming
  - From connection side Ap.1 on the left, Ap. 2 on the right
  - All magnets have vertical dipole (i.e. horizontal kick, H label in the circuit) for Ap. 1, and horizontal dipole (i.e. vertical kick, V label in the circuit) in Ap. 2
    - Note that in the LHC, the MCBC and the MCBY have half and half (type A or B)
  - We are reviewing all test reports to account for the good convention
    - Some old slides could still have wrong naming

- Convention for multipoles
  - Normalized to the main field absolute value
  - The angle is refered to the reference system (x – radial, y – vertical) therefore we have 10 units of systematic b3 in Ap. 1 and -10 units of systematic a3 in Ap. 2
D2 CORRECTOR

- All data confirm the ±10 units of geometric b3/a3
  - This is at the edge of the specification
  - For Ap. 1, saturation always pushes the b3 down to 5 units
  - For Ap. 2, the powering of Ap. 1 pushes a3 towards 15 units
- This is the reason for which we are carefully analysing this issue and trying to centre the geometric around zero
  - More information at the beginning of next year
**TRIPLET TRANSFER FUNCTION**

- **Available measurements:** assembled magnet at room temperature: 03, 04, and 05
  - MQXFA05 40 units larger than previous two

<table>
<thead>
<tr>
<th>Name</th>
<th>Central TF (T/kA)</th>
<th>Integral TF (T m/kA)</th>
<th>Diff to MQXFA03 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MQXFA03</td>
<td>8.830</td>
<td>37.200</td>
<td>-</td>
</tr>
<tr>
<td>MQXFA04</td>
<td>8.828</td>
<td>37.178</td>
<td>-0.06%</td>
</tr>
<tr>
<td>MQXFA05</td>
<td>8.870</td>
<td>37.350</td>
<td>+0.40%</td>
</tr>
</tbody>
</table>
Available measurements: coil pack (room temperature): 03, 04, 05 and 06
- MQXFA06 is placed in between MQXFA05 and MQXFA03/4
- Difference between 05 and 06 around 0.25% (25 units)
Measurements of MCBXFP2

- Careful optimizing of shimming for getting good preload and reasonable field quality
- $b_3$ perfectly centered:
  - -7 units for inner dipole only
  - 0 units for outer dipole only (by symmetry)
  - About 10 units for combined powering
- $b_3$ saturation depends on the powering ratio inner/outer and spans 20 units
**MCBXFB**

- **Measurements of MCBXFBP2**
  - Careful optimizing of shimming for getting good preload and reasonable field quality
  - $a_3$ should be centered around 10 units to compensate saturation, it is around zero:
    - 0 units for inner dipole only (by symmetry)
    - -10 units for outer dipole only
    - About -10 units for combined powering at 1000 A in each aperture, and increasing towards 20 units at 1500 A
  - $a_3$ saturation depends on the powering ratio inner/outer and spans 20 units
**MCBXFB**

- **Measurements of MCBXFBP2**
  - Careful optimizing of shimming for getting good preload and reasonable field quality
  - $b_5$, $b_7$ well below 10 units
  - Other not allowed below 5 units

![Graphs showing multipole units vs. current for $b_5$ and $b_7$.]
**A TENTATIVE TABLE**

- For the present situation of MCBXFBP2

<table>
<thead>
<tr>
<th>H kick (V inner dipole)</th>
<th>V kick (H outer dipole)</th>
<th>b3</th>
<th>a3</th>
</tr>
</thead>
<tbody>
<tr>
<td>nom</td>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>nom</td>
<td>nom</td>
<td>10</td>
<td>-20</td>
</tr>
<tr>
<td>0</td>
<td>nom</td>
<td>0</td>
<td>-8</td>
</tr>
<tr>
<td>-nom</td>
<td>nom</td>
<td>10</td>
<td>-20</td>
</tr>
<tr>
<td>-nom</td>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>-nom</td>
<td>-nom</td>
<td>10</td>
<td>-20</td>
</tr>
<tr>
<td>0</td>
<td>-nom</td>
<td>0</td>
<td>-8</td>
</tr>
<tr>
<td>nom</td>
<td>-nom</td>
<td>10</td>
<td>-20</td>
</tr>
</tbody>
</table>
SUMMARY

- **D2 corrector**
  - We reviewed the naming conventions, and we show why the 10 units of geometrics do not fit the requirements
  - Study of the influence of key position and iron shape, results in the first months of 2021

- **MQXFA**
  - We presented the data of 4 magnets, we are within a band of 0.4% (40 units) width

- **MCBXFB**
  - We presented the data of the second prototype, b3 very well centered, a3 has 10 missing units but they both stay within 20 units target