



# Workshop on Field Quality Steering



- **General overview**

- Total of **18** speakers divided into **5** sessions.
- Topics covered: AP (target errors, beam dynamics issues), evolution of dipole design, geometry and alignment, follow-up (warm and cold), components and field quality, production analysis (for feedback), steering the field quality.
- A selection of presentations will be reviewed as an introduction to the main topics (reported by C. Vollinger) that were presented/discussed at the workshop.



# AP Considerations (I/II)



- **How target errors evolved? (J.-P. Koutchouk)**
  - First target error table: 9901
  - The new reference is the LHC PR 501 (for main dipole) that represents essentially a consolidation, but...
    - $b_5$ : **it calls for tests of off-momentum dynamic aperture.**
    - $b_7$ : the asymmetric bound might require further analysis.
- **How are defined target errors? (O. Brüning)**
  - **Mechanical aperture**: imposes bounds on closed orbit, parasitic dispersion, momentum spread, momentum offset,  $\beta$ -beating etc.
  - **Alignment errors**: imposes bounds via feed-down analysis.
  - **Beam dynamics**: imposes bounds on tunes (vs. amplitude, momentum offset, mixed terms). Target dynamic aperture:  $12 \sigma$ .



# AP Considerations (II/II)



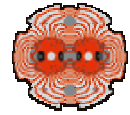
- **Present status (S. Fartoukh)**
  - **B dL** is systematically higher for FIRM 3 magnets. Possible solutions: **steering field quality** (no impact on closed-orbit correctors), **installation** (some impact on closed-orbit corrector system).
  - **Field direction** is not an issue (measurements results obtained with the **single stretched wire** are expected to be cross-checked with those from **improved version of the long shaft**).
  - **Dynamic aperture**: the random part of  **$b_3$  (injection)** dominates the dynamic aperture. However, the present estimate of  $b_3$  random is rather pessimistic, due to mixing of cross-sections, non-standard components.
  - **Positive point**: sorting of 35 pre-series dipoles does not seem necessary.
  - Odd multipoles:  **$b_3$  (high-energy)** and  **$b_5$   $b_7$  (injection)** are outside bounds.
  - **NB: feed-down effects should be considered in detail.**



# Dipole geometry (I/II)



- **Dipole shape at warm (M. Bajko)**
  - Severe difficulties with **dipole shape** due to spring back. The solution found was **re-shaping** (after welding).
  - **Re-shaped** dipoles show signs of **instability**: they come back to initial shape. **Six** out of eleven show this behaviour (but **ten** more in industry...)
  - Impact on spool piece correctors alignment, hence feed-down effects.



# Dipole geometry (II/II)



- **Analysis and trend of dipole geometry (W. Scandale)**
  - The spread in dipole shape is rather large.
  - It is confirmed that **re-shaping is not a stable solution** to cure dipole shape. The goal is to find better solutions within the first six months of the year 2003 (until then re-shaping is stopped).
  - Large movements of **dipole heads** are observed (critical for spool piece positioning)
  - No measurements have been performed to check whether the magnet continues moving after each cool-down.
  - **Quenches** do not have a significant impact on shape.