Derived Parameters from Dipole Geometric Measurements

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Introduction

- Derived parameters are calculated (when meaningful) for all measurements : ITP15, ITP20, WP01, WP03, WP08, WP08*X* .

- Those parameters are used :
  - to evaluate the dipole stability (validation of the central foot blocking).
  - to allocate a slot for a magnet in the machine.

- Some are already in the ID Card, others will be soon in.

- All parameters are stored in the Database.

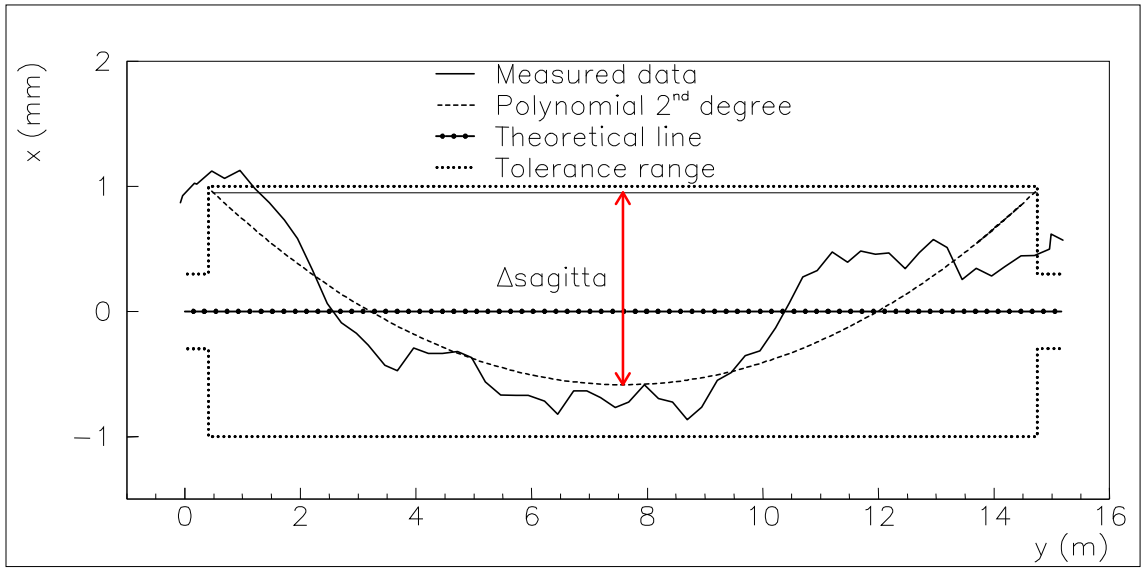
“Miscellaneous” parameters

- Average, maximum and minimum for ΔX and ΔZ for both apertures. Also Body_R (maximum ΔR).
- The tenth degree polynomial approximation coefficients and his longitudinal range of use (to avoid dangerous extrapolation at the extremities).
- An indicator to show the quality of the polynomial interpolation of tenth and second degree.

"Stability" parameters (1/3)

Delta Sagitta

- Calculated on the bend part of the dipole : 14.343 m.
- Estimated on fitted data with a polynomial approximation of second order.
- Convention used : a Δsagitta positive means a magnet too curved.

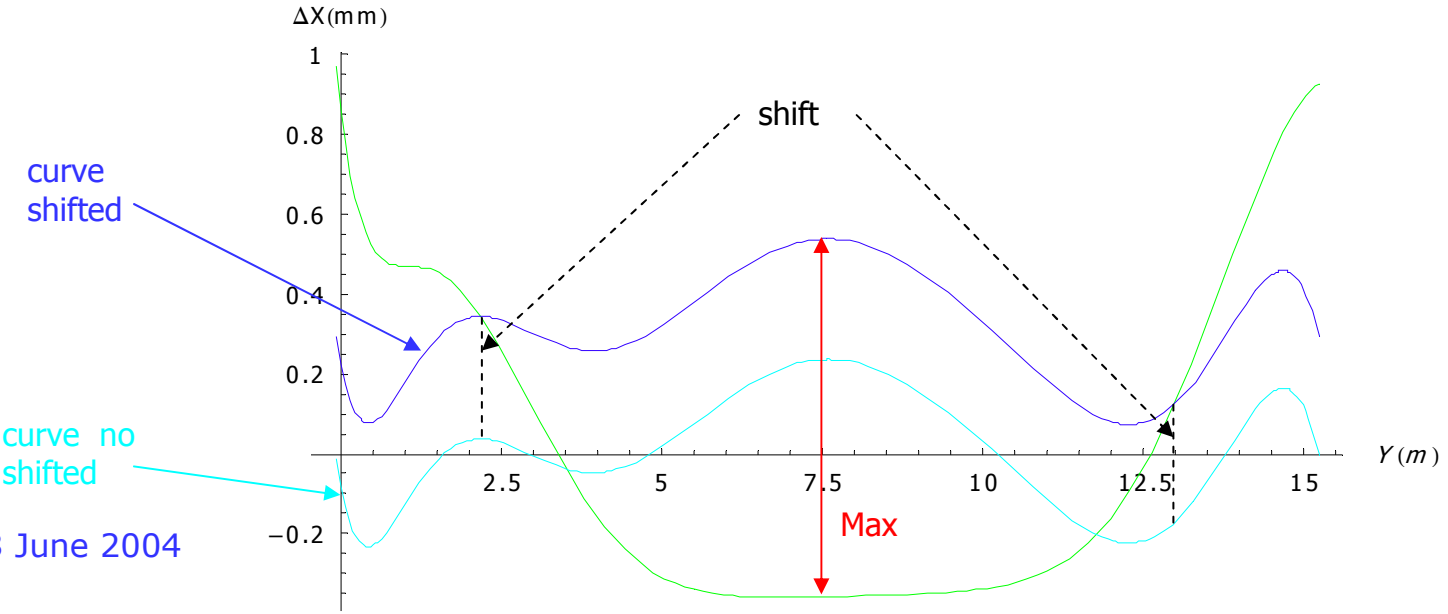


Courtesy of
Giuseppe Gubello

"Stability" parameters (2/3)

Maximum & RMS distance

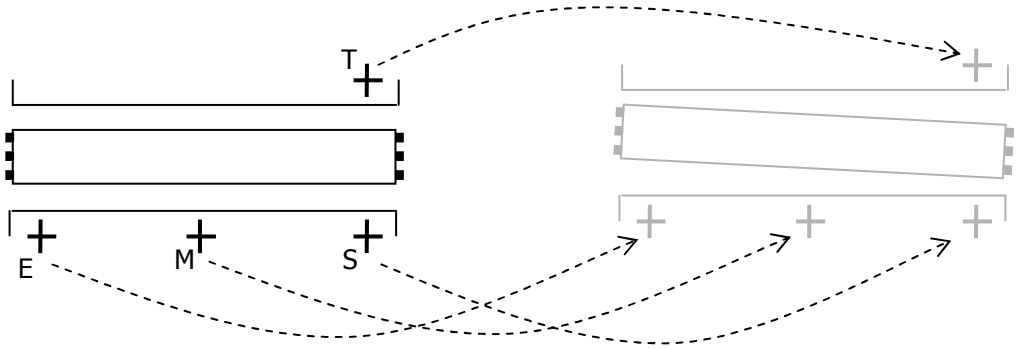
- Calculated on two following measurements steps.
- Estimated on fitted data with a polynomial approximation of tenth order.
- Performed on shifted curves w.r.t external cold feet pads, with the assumption there is no transversal movement on the external cold feet pads. The shift can be different on the two feet.



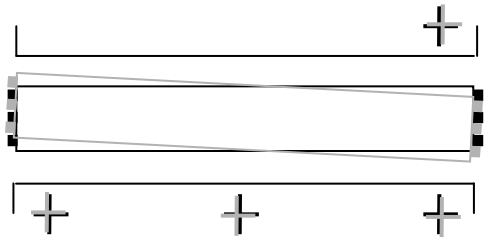
"Stability" parameters (3/3)

Movements of "D points" w.r.t to the fiducials

- Enables to evaluate the movement (rotation and translation) of the cold mass w.r.t to the cryostat.
- Calculated on two following measurements steps : $WP08_i$ and $WP08_{i+1}$.
- A best-fit (with an Helmert transformation) is performed on the fiducials from the two steps. Then, this transformation is applied to the "D points".



Fiducials adapted on the previous step



Mechanical twist

- Perform to make easy correlation with the magnetic twist.
- Thus a local twist is calculated with the following formula :

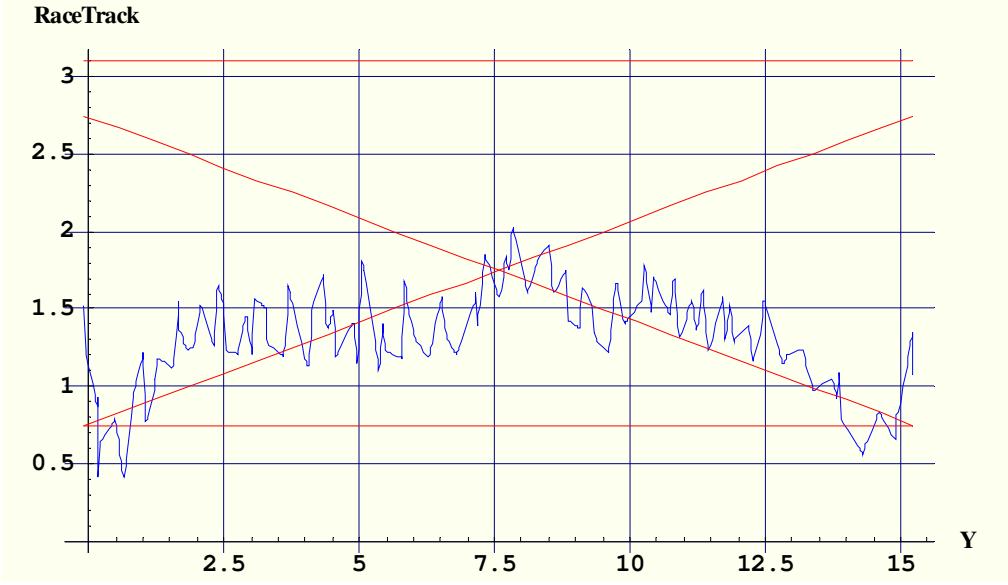
$$tw_{loc} = \mathrm{Arctan}\left(\frac{Z_{j,\,v2} - Z_{j,\,v1}}{X_{j,\,v2} - X_{j,\,v1}}\right)$$

- It is computed on 18 positions, of 0.75m long, which are corresponding to positions of the warm magnetic field measurements made in industry. Positions at extremities are excluded.
- Therefore, an average and a RMS are calculated from local twist.
- Furthermore, a twist integral is defined with a discrete convolution as follows :

$$tw_{sum} = 0.75 * \sum_{i=1}^{i=18} tw_{loc,i} * (13.5 - i*0.75)$$

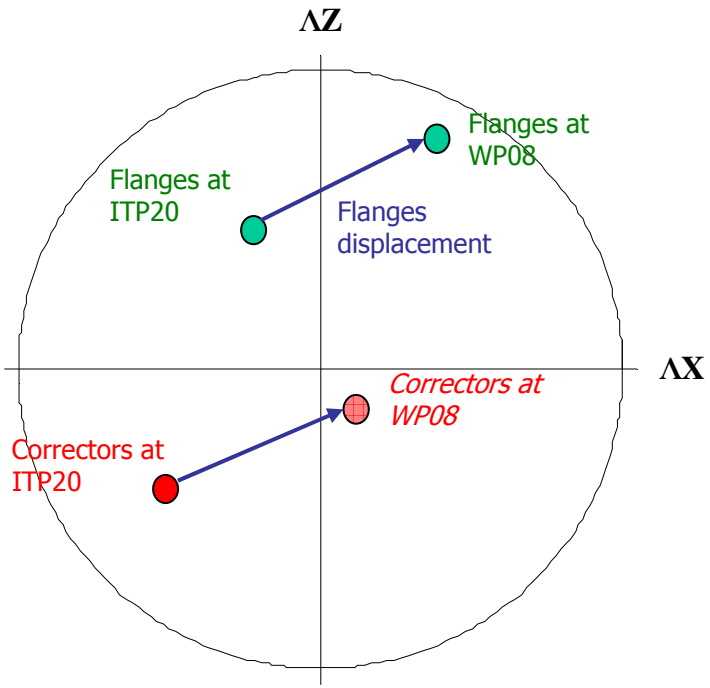
Classification

- Compute the racetrack (specification given by ABP) to determine the class (golden, mid cell, silver , etc) of a magnet.
- For the time being, only the class is stored in the DB and not the racetrack values.



Correctors position at WP08

- Aim : calculate the position of correctors at WP08, without measuring them.
- Assumption : cold mass extremities are rigid, thus correctors follow movement of flanges between ITP20 and WP08.



So correctors positions at WP08 can be estimated by :

$$Cor_{WP08} = Cor_{ITP20} + \overrightarrow{Fl_{ITP20}Fl_{WP08}}$$

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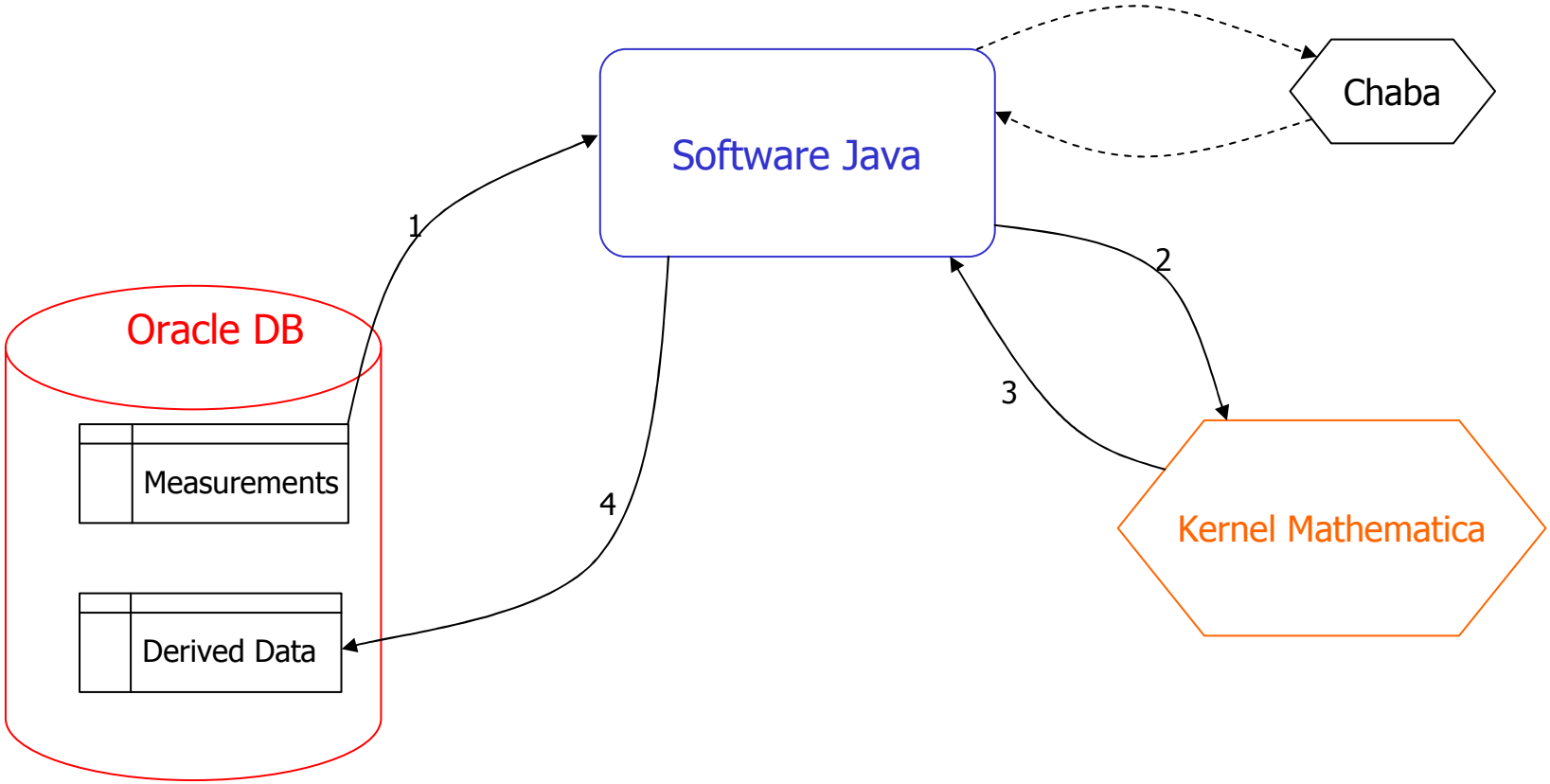
Technology


Chaba
Software Java
1
2
3
4
Oracle DB
Measurements
Derived Data
Kernel Mathematica

Acknowledgements

Elena Wildner, Dominique Missiaen, Fabien Seyvet

Giuseppe Gubello, Walter Scandale

Gregory Bevillard, Christophe Podevin

Rocio Chamizo, Marta Bajko

ABP