ALIGNMENT OF STORAGE RING MAGNETS AT SLS

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SLS/Paul Scherrer Institute, CH-5232 Villigen PSI , Switzerland

1. INTRODUCTION

The SLS storage ring consists of 174 quadrupoles 120 sextupoles placed on 48 girders. To ensure a smooth orbit, special attention was given to the alignment of storage ring magnets. The girders have special centering grooves for horizontal and vertical positioning. Measurements of the mechanical centers (magnet laminations) were done to verify the correct installation of the SLS storage ring magnets, using the laser tracker LTD500.

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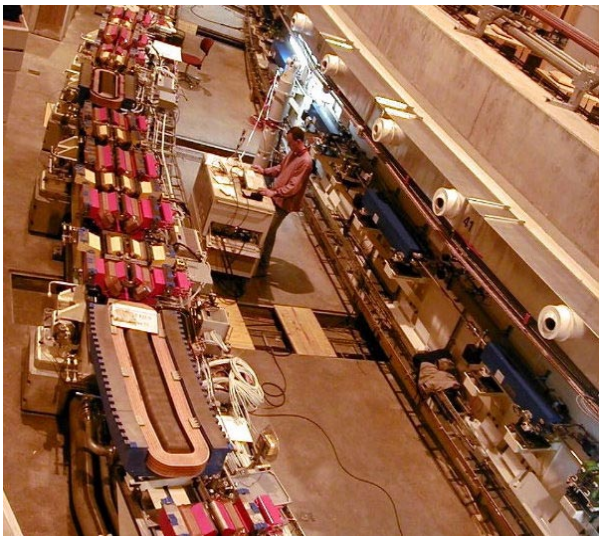
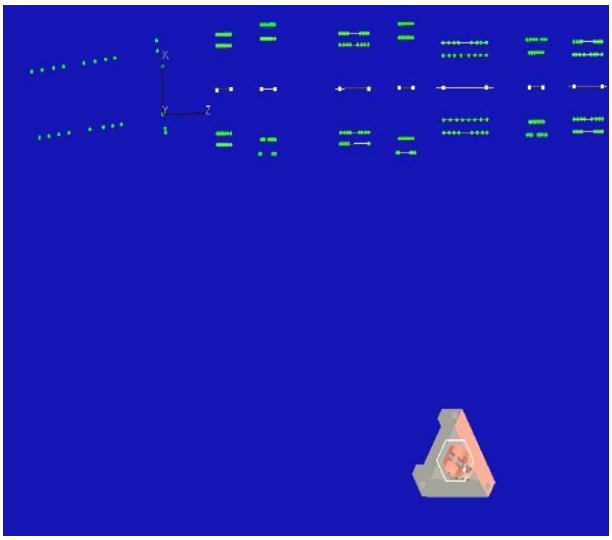
2. MEASUREMENT SETUP

The instrument for the measurements was the laser tracker LTD500 (LEICA). The accuracy of the measured coordinates is approximately 10 ppm. We set up the instrument as close as possible (ca. 2.5 m) so we can assume an accuracy of 25 µm for the registered coordinates.



Img. 1 Opened SR magnets

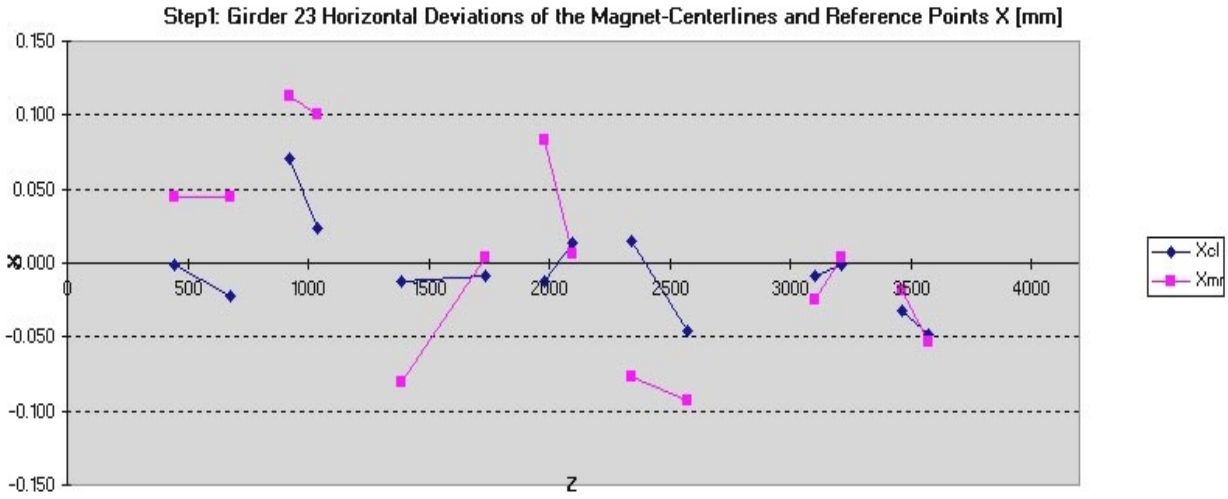


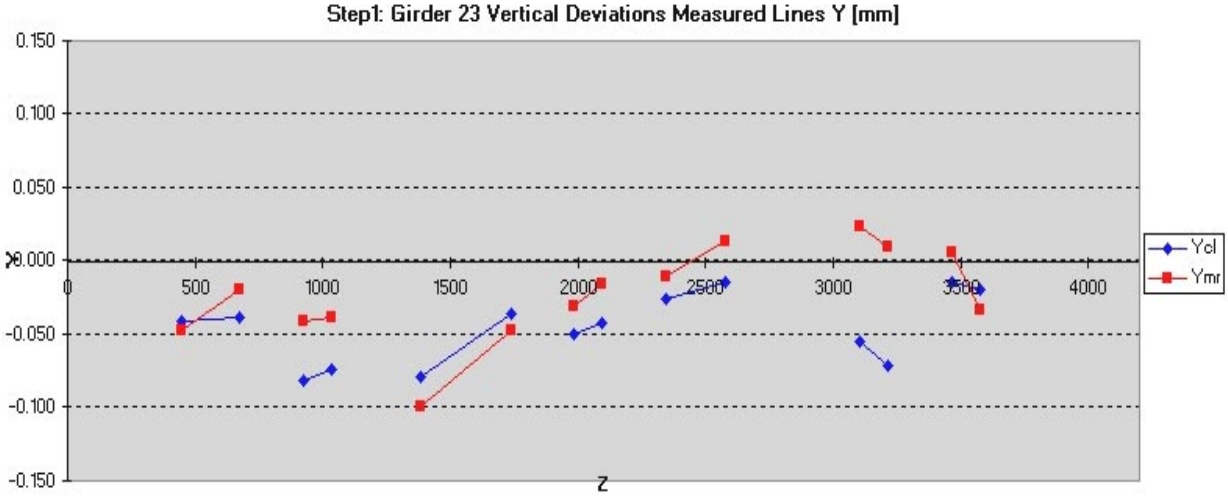
Img. 2 Measurement scheme (edges of magnet lamination)

3. DATA REDUCTION

3.1 Reduction to local beam coordinate system

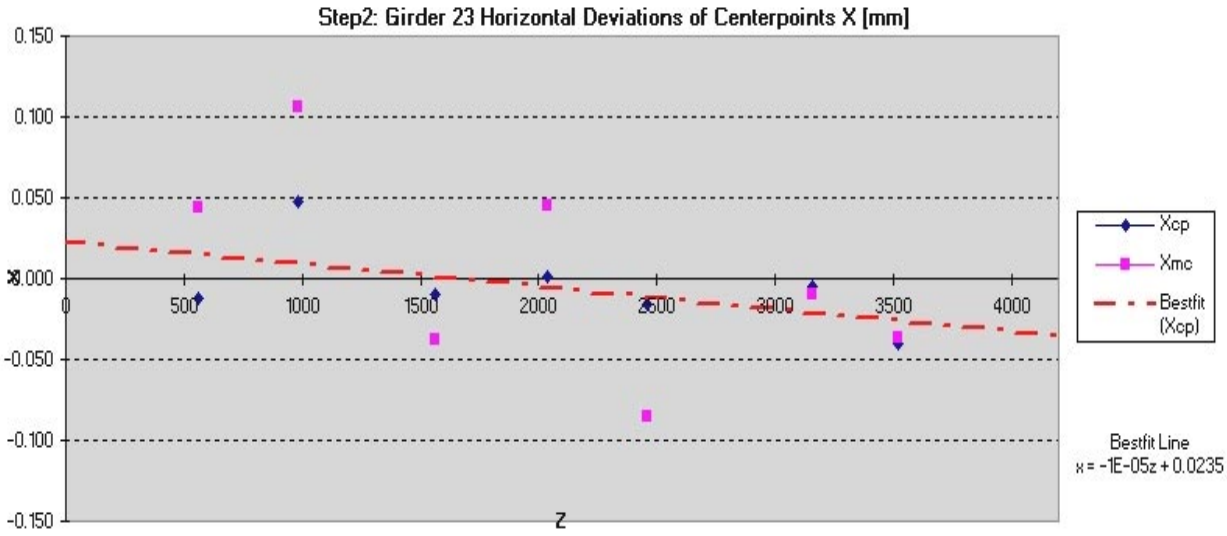
These charts showing the deviations of the measured centerlines to the ideal theoretical axis and the deviating coordinates of the reference holes (magenta/red) to the measured lines (blue) **Step1** Because of the variance in reference hole diameter, the deviation in horizontal is much bigger than in vertical direction, which is defined by a plane surface.

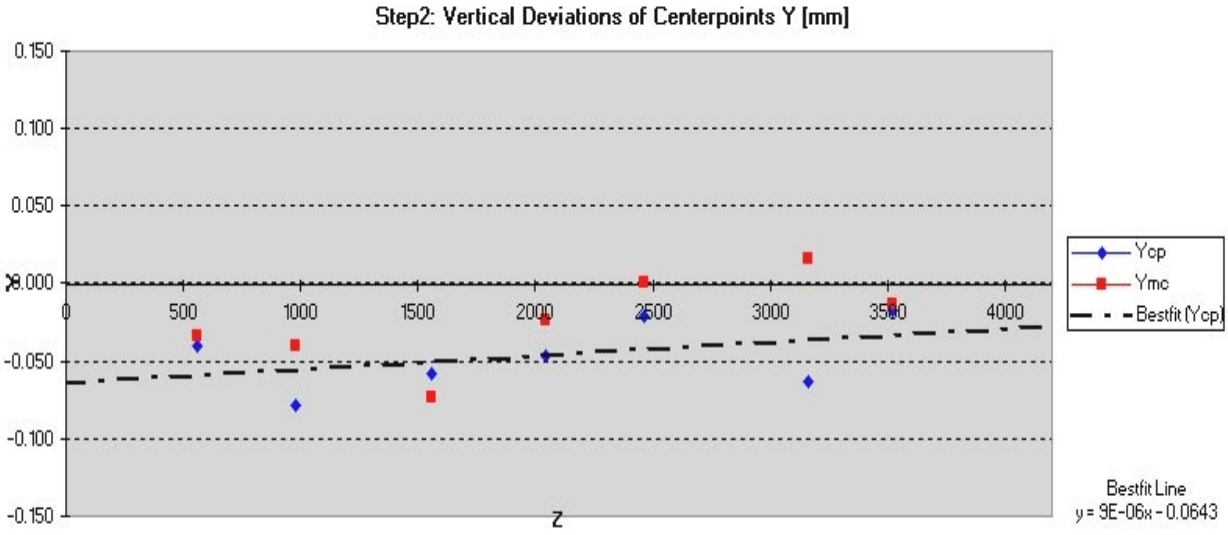




3.2 Reduction to center points

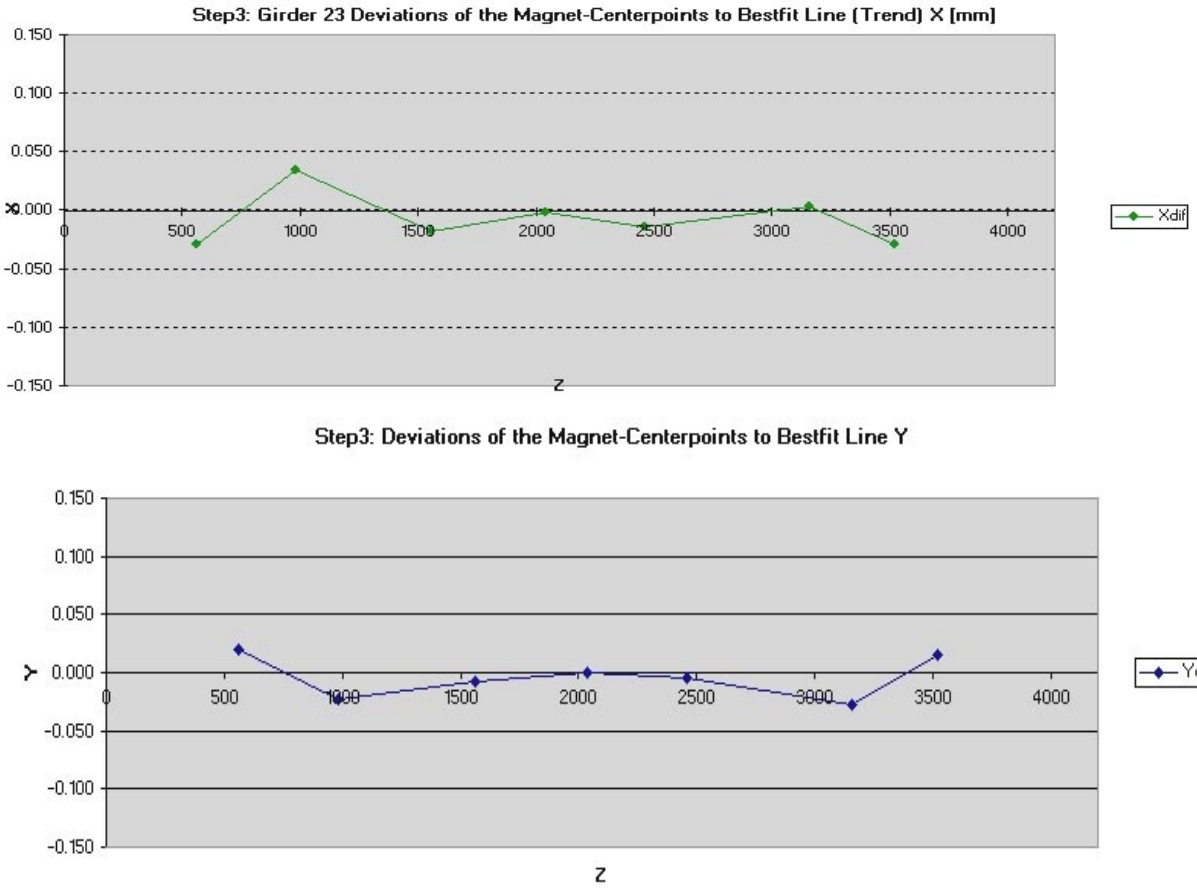
Most important for the beam quality is the correct location of the magnet center points **(Step2)**. In this case we assume that the magnetic center is identical with the geometrical center. The center point can be easily calculated from the measured lines. Since all the measurements were done before the final alignment, there is a linear portion of girder misalignment included.





3.3 Reduction to best fit

To eliminate this influence we calculate a linear trend (best fit line) and subtract it from the deviations



4. CONCLUSION

The deviations of the measured magnet center points to the theoretical positions (all measurements) are less than 100 µm. The vertical accuracy of the magnet positions is better than the horizontal accuracy (factor 2). There are significant deviations of the reference holes to the magnets' geometry, but these deviations are stochastical (non-systematic).Since the number of reference holes per girder is sufficient, the reference holes are suitable for the final alignment of the SR.

5. POSTER

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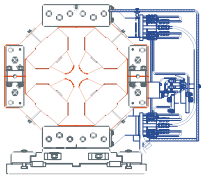

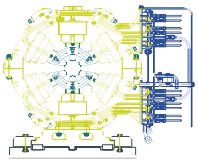

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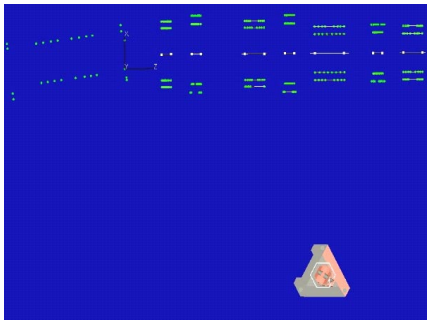

Measurement scheme (edges of magnet lamination)

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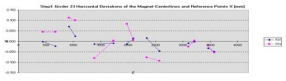
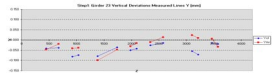
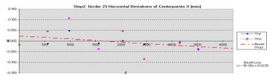
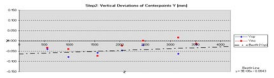
Reduction to local beam coordinate system



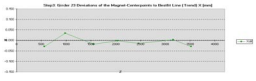


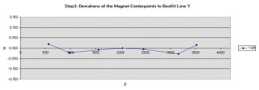
Step 2:
Reduction to center points





Step 3:
Reduction to best fit





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