Abstract

The new Brazilian Light Source, Sirius, will be commissioned in 2018 and is considered by many as a fourth generation Synchrotron facility project. The Survey and Alignment activities are currently in the planning phase and one of the focus is the target holder development. These target holders will be installed in our accelerator to serve as a network of reference points to be used in the alignment process. In this paper, we are interested in assessing the capability of our concepts in maintaining the center of the Laser Tracker optical target in the same position as it is repositioned. We performed an experiment designed to compare six models and run an analysis of variance to evaluate the data. A performance measure was defined in order to take into account repeatability errors of repositioning the optical target. We were able to verify statistical differences of small magnitude between the concepts. The quantitative results will be used to help in the decision-making.

Application

- Use of a Coordinate Measuring Machine – CMM in CNC mode;
- Location of the SMR with 16 hits;
- Temperature compensation disabled;
- Temperature variation smaller than 0.2 ºC;
- Location of the Target Holders measuring a plane and a circle;
- Location of the origin before each repetition;
- Execution of the experiment in a completely randomized manner;
- 30 observations of each model;
- Use of gloves to minimize thermal gradients between operator and apparatus;
- Screw fixation of the alignment support part and glue to avoid target holders displacement;
- Thermal stabilization of the tested models for at least 24 hours;
- Use of the same SMR in the same position during all measurements, to avoid the effect of sphericity errors;
- Cleaning of the contact region to remove possible deposited dust.

Methodology

- Aluminium body
- Aluminium body with encrusted spheres
- Three frustums areas
- Aluminium plated with electrolytic nickel
- Stainless steel body
- Aluminium plated with chemical nickel

Performance Measure

\[
\mathbf{P} = \bar{c}_{\text{SMR}} - \bar{c}_{\text{THolder}}
\]

**ANOVA test**

**Model Adequacy Checking**

Conclusion

This work allowed the statistical comparison between six concepts of target holders for laser tracker optical retroreflectors, relative to their potential to repeat the position of the measured point.

We have found a statistical difference between the mean stability error of the models, and two of them showed best results.

The findings of this study suggest the possibility that a new concept, arising from the merge of designs C and F (segmented cone and aluminum with nickel chemical coating, respectively), might present better performance [10]. Although the statistical difference between the designs, the magnitude of the stability error differ no more than 0.00026 mm between all concepts. Considering the Laser Tracker uncertainty, the stability error cannot represent a major decision factor.