THE SURVEYING DATA PROCESSING OF CONTROL NETWORK BASED ON HLS UPGRADE*

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Abstract

The paper introduces the data processing procedure of control network based on the HLS upgrade. The Spatial Analyzer developed by New River Kinematics was used to adjust the data of surveying. In order to check the correctness of the adjustment result, The MAA developed by IHEP was also employed to make three-dimensional adjustment as well as plane adjustment done by SURVEY adding elevation adjustment by NASEW2003. Through comparing the results adjusted by different software, the SA is demonstrated reliable. At last, the cause why different software produces different results was analyzed depending on the adjustment principle of different software.

INTRODUCTION

Hefei Light Source （ HLS ） was designed and constructed in the 1980s, and formally opened in 1992. The second stage of the project was constructed from 1999 to 2004, during which eight beam lines were added, and some equipment was updated to improve light source stability. From June of 2010, on the basis of the NSRL, HLS has been a major renovation to make the synchrotron radiation light higher brightness and more stable [1]. The subject of the HLS includes a 73.435 meters' line accelerator and a 66.13 meters' storage ring. Beam lines and experimental platforms are distributed in the outside of the storage ring.

In the process of actual measurement, the Leica and FARO laser trackers are used to measure the control network points' 3D coordinates and the N3 Level is used to measure the control network points' elevation (Fig.1).

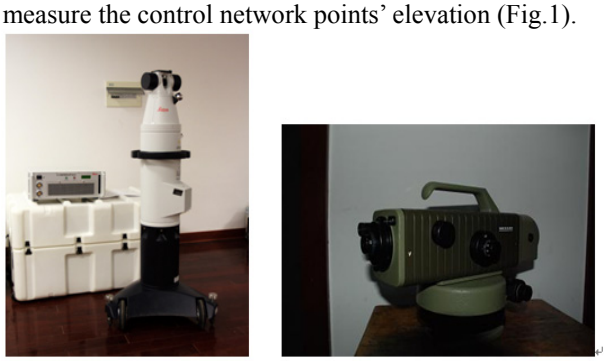

Figure 1: The instrument of measuring: Laser Tracker and N3 Level.

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About software, the SA was used to collect and process data. The SA is a powerful graphical measurement software that developed by New River Kinematics company of American, it can connect and drive almost all measure instruments, display just like Fig.2.

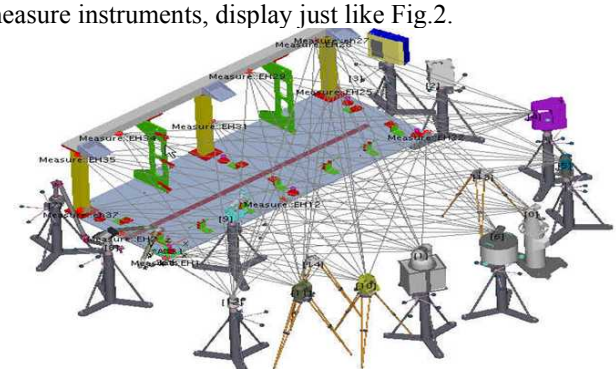

Figure 2: Connecting all kinds of instruments into SA.

DATA PROCESSING

After actual measurement, we got a lot of measurement data, including all control network points' 3D measurement data by laser tracker, the global horizontal control network points' data measure by total station and elevation data by N3 Level [2].

Firstly, the COSA software developed by Wuhan University was used to adjust the global control network points' data for obtaining the global control network adjustment result. At same time, the NASEW2003 was used to adjust the elevation data by N3 Level, the result was putted on an Excel form. Lastly, the measurement data of Laser Tracker and two context results was imported into the SA. The best-fit function of SA was used to obtain the second control network (Fig.3) and calculating [3].

The Unified Spatial Metrology Network (USMN) is a characteristic and important function of the SA, it can processes all measurement data of varies kinds of instruments in a unified spatial based on common reference points. The processing result includes correct value and uncertainty of all points. By using the USMN of SA, the global control network adjustment results were used as control points to adjust the second control network(Figure 4).

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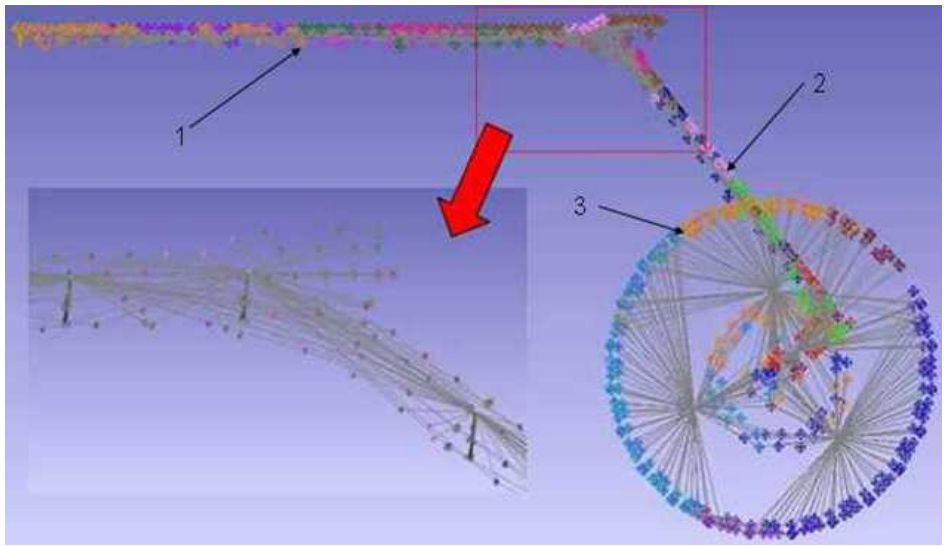

Figure 3: The second control network of HLS:1—Line Accelerator 2—Transport 3—Storage Ring.

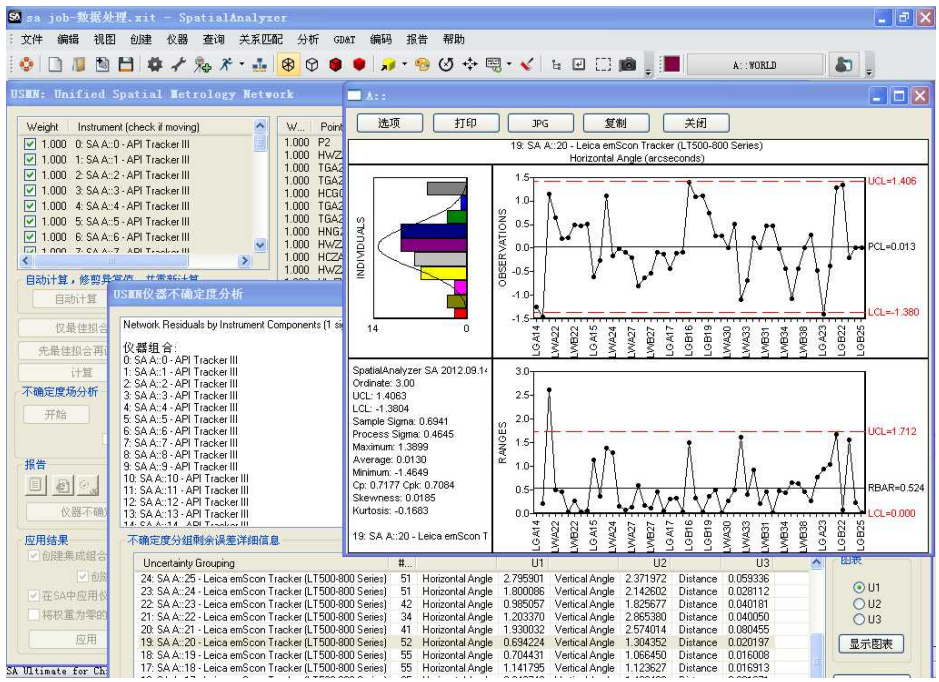

Figure 4: The processing data window of USMN.

Because it is the first for us to use the SA to process the whole control network data in such important Program, it is necessary to check the calculated result using different software. The MAA developed by IHEP was employed to do three-dimensional adjustment as well as SURVEY was used to do plane adjustment adding NASEW2003 was used to do elevation adjustment.

The data of results of different software were put a form, among same points' name should be put in same line. The data of X, Y, Z of each points measured by SA subtract the data measured by MAA, obtain the ΔX, ΔY, ΔZ of each point. The result could be drawn as picture(Fig.5). At same way, another picture could be obtained through comparing the result of SA and SURVEY adding NASEW2003(Fig.6).

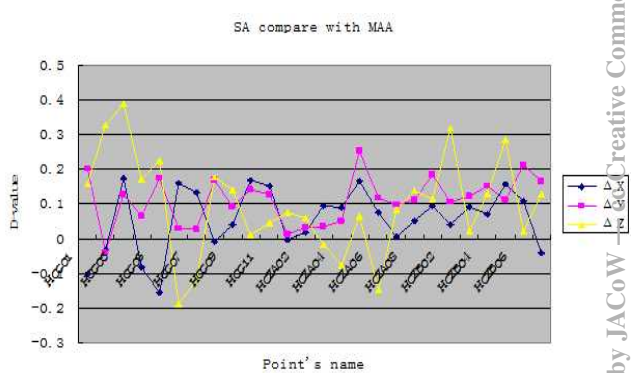

Figure 5: ΔX, ΔY, ΔZ SA compare with MAA.

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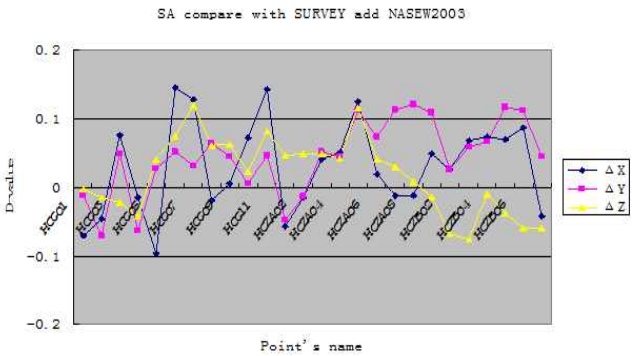

Figure 6: ΔX, ΔY, ΔZ SA compare with SURVEY add NASEW2003.

Through comparing with results, it was found that the SA result is closer the result of SURVEY add NASEW2003 than MAA, the average of ΔX and ΔY is not bigger than 0.15mm, and the average of ΔZ is just only 0.005mm.

CONCLUSION

Because of the models of different adjustment software are different, the coordinate values of small number of points are different, but most points' coordinate D-value are not beyond 0.1mm, proves that the result of SA is reliable.

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