LHC SURVEY LASER TRACKER CONTROLS RENOVATION

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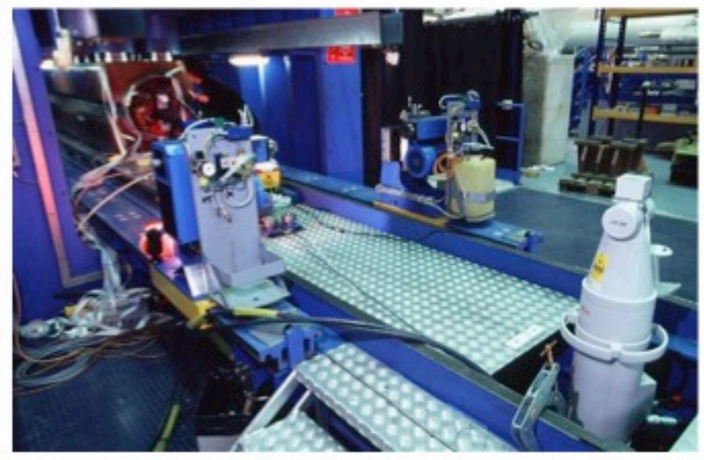
ABSTRACT

The LHC survey laser tracker control system is based on an industrial software package (Axyz) from Leica Geosystems™ that has an interface to Visual Basic™, which we used to automate the geometric measurements for the LHC magnets. With the new version of the Leica software, this Visual Basic™ interface is no longer available and we had to redesign our interface software to adapt to a PC-DMIS server that replaced the Axyz software. As this package is no longer supported, we have taken the decision to recode the automation application in LabVIEW™. This presentation describes the existing equipment, interface and application showing the reasons for our decisions to move to PC-DMIS and LabVIEW™. We present the experience with the first prototype and make a comparison with the legacy system.

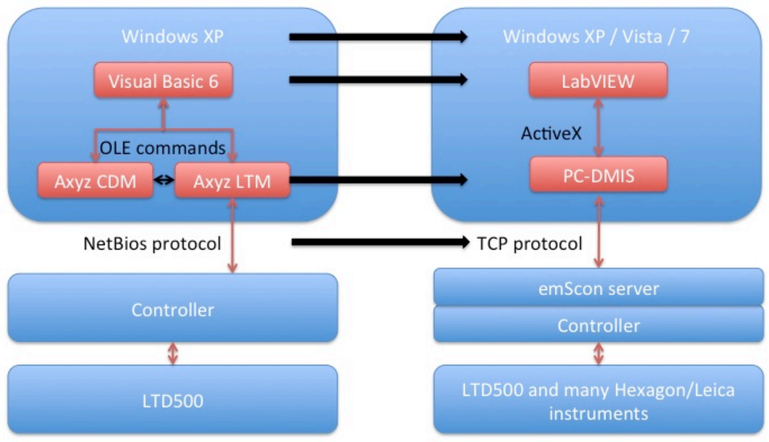
Geometric measurement for the LHC magnets

As the required tolerances on the geometry [1] of the LHC cold masses and on the positioning of some of its components are very tight, the final steps of the assembly are assisted by 3D optical measurements. From 2001, a Visual Basic™ program written at CERN (i.e.: Magnet Geometric Measurement – MGM) with direct access to the command library of the Leica Geosystems™ software, called Axyz, executes every sub-routine of the measurement process [2]. To be able to continue using the geometric measurement program for the LHC lifetime, the upgrade of the software components was decided.



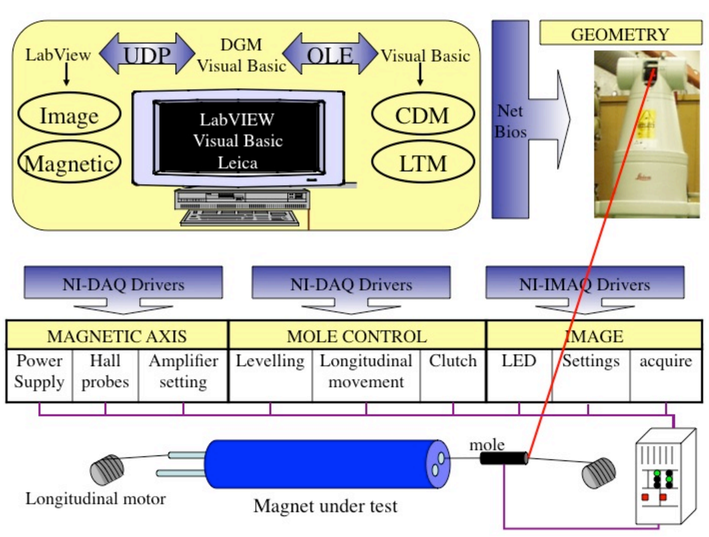
Legacy software and hardware

The system is running on WindowsXP, using Visual Basic™ 6.0 and Axyz software to control a LTD500 Laser Tracker. The communication between MGM and Axyz is based on OLE commands. The measurements are performed through the Laser Tracker Module (LTM) after having defined many operational parameters. The results are stored in the Core Data Module (CDM), which is accessible by the MGM for mathematical treatment of the raw data.



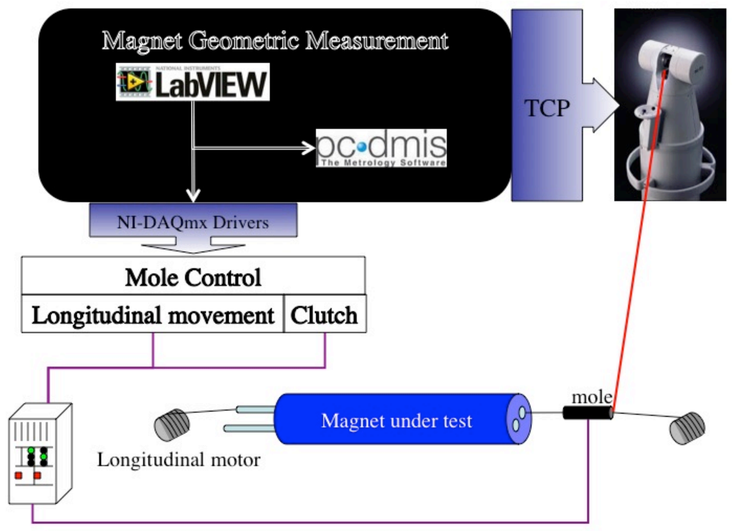
Software and hardware from 2011

The most expensive tool used is the LTD500. This hardware fulfils CERNs requirements to build and repair magnets for the LHC. However, when the need will come to buy a new laser tracker, the MGM have to be adapted with a minimum effort. The application proposed by Leica Geosystems™ is called PC-DMIS. This application cannot be connected to the laser tracker directly, and a server (i.e.: emScon server) has to be added in the chain of equipment. The emScon server translates the request from PC-DMIS to commands understandable by the laser tracker.



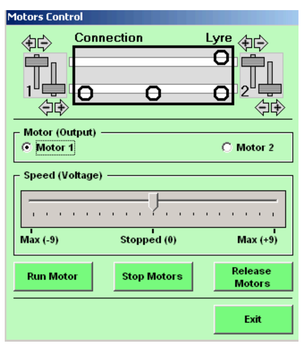
Using PC-DMIS commands

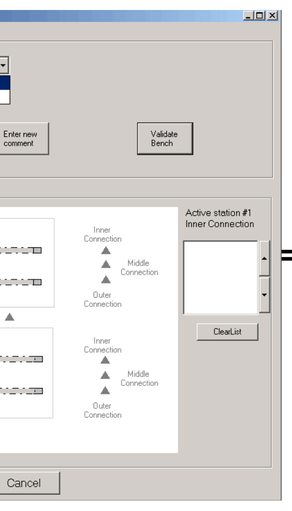
PC-DMIS automation is language independent and provides a list of methods, properties and events for each PC-DMIS automation object. Performing an action like measuring a point usually involves inserting a command to the script and executing it.

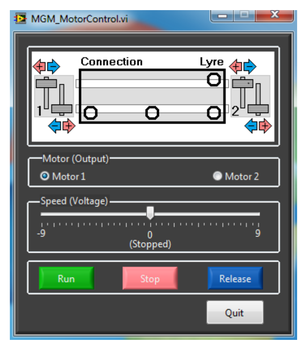


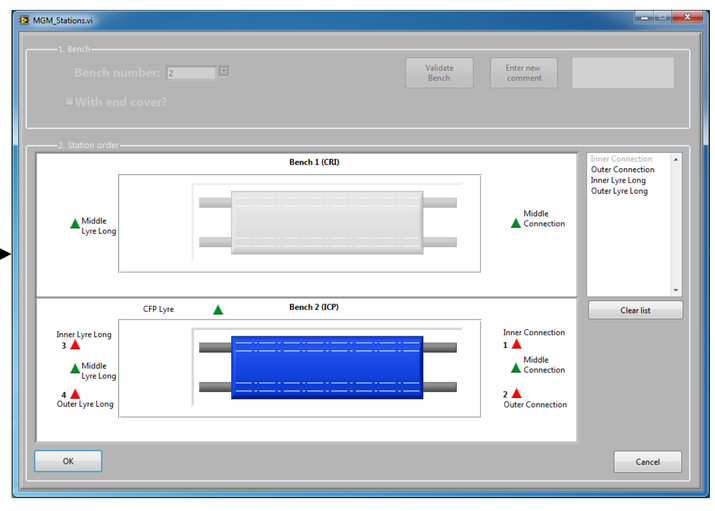
Speeding up development and maintenance

The choice was made to develop MGM using LabVIEW™, because it was the most suited to fulfil the requirements of flexibility, adaptability, quality, integration into industrial control software and light maintenance. Now that LabVIEW™ has been chosen, access to the ActiveX component are just as easy as with Visual Basic™. However, the calculations, displays and data storage are already built-in functions, those only needs to be arranged together. To ease the development, a LabVIEW™ to PC-DMIS library of drivers has been created including the main functions required for the MGM. This means that for each alignment module, the developer will not have to go through the entire PC-DMIS library again.









CONCLUSIONS

The existing MGM Visual Basic™ application has given successful results during the magnet construction for the LHC. Now the new system look promising and the development time has been shortened a lot using LabVIEW™ and the homemade dedicated palette to PC-DMIS. The next step could be to develop a second palette for LabVIEW™ to emScon to avoid using the heavy environment for small automations.