# LabVIEW Control Applications for Cave A and SHIPTRAP

Dietrich Beck, Holger Brand, Klaus Poppensieker and Kai Wunderle, DVEE, GSI

## 1 Stepper Motor Control for Cave A

A control system is required to operate up to 16 stepper motors in Cave A. These are needed for experiments performed by the Atomic Physics Division. All stepper motors have to be controlled at the same time from outside the Cave.

A first system has been set up that is able to control six axes[1]. The hardware is based on FlexMotion PCI cards from National Instruments[2] and an amplifier built by Movtec[3]. The software is written using LabVIEW from National Instruments. Although this system has been successfully used in a couple of beam-times, it is not intended to extend it to 16 axes. The reasons for that are the following. First, the design of the system is not suitable for a distributed system that is controlled remotely. The main limitation here is the length of cables and a missing modularity. Second, quite a few hardware bugs were found and had to be cured before that system was operational. Third, some hardware components are especially built for this set-up and not available off the shelf.

A couple of products of different companies have been evaluated. As a result, it was decided to use components from another company, IEF Werner[4]. The quality of these components has industry standard, can be used without modification and can be controlled from outside Cave A via a Profibus interface (see below). The control software is presently implemented with LabVIEW.

## 2 Using Profibus from LabVIEW

Profibus is an field bus with an open specification and frequently used and supported by industry [5]. Profibus master cards for PCs are available by various suppliers together with so called OPC servers. The input and output parameters of Profibus are represented by process variables, so called tags, on the OPC server. They can easily be accessed by other PC applications like LabVIEW.

Three combinations of Profibus master card and OPC server were evaluated.

- Comsoft[6]: The OPC server and Profibus master are the ones which can be used most easily. Unfortunately, no fiber optics but only RS485 connectors are supported.

- Siemens[7]: Presently, Siemens is the only manufacturer supporting the RS485 as well as fiber optics connectors. Unfortunately, the configuration of the OPC server is less user friendly than for the ones of Comsoft and Beckhoff.

- Beckhoff[8]: The OPC server from Beckhoff gives access not only to Profibus but to all common field busses like CANopen, Interbus, Modbus and others. Moreover, intelligent and non intelligent bus terminals with Ethernet connections are supported as well. In addition, the configuration of the OPC server is still fairly easy. Profibus master cards with fiber optics are not yet available but will be during this year.

To summarize, it is recommended to use the Profibus master card and software from Beckhoff.

## 3 The Control System for SHIPTRAP

SHIPTRAP is a facility that is tailored to slow down, cool and purify short lived trans-uranium isotopes delivered by SHIP. Experiments will be done either with SHIPTRAP itself or with other set-ups that are placed behind SHIPTRAP and which require cooled, purified and low-energy ions. The design and implementation of the control system for such a facility is challenging [9]. About 1000 process variables have to be controlled. The experimental procedures require timing sequences to control actions with a precision of about 100ns. The different operational modes that will be used require the control system to be highly flexible. The control system will consist of two parts. First, there is a general control software package that can be used as a framework for other experiments as well. Second, there are SHIPTRAP specific add-ons. The general part of the system will be implemented in collaboration with other trap experiments.

Presently, the first version of the general part of the control system is finished. For the implementation, an object oriented approach, that is made possible by a toolkit from Vogel Automatisierungstechnik[10], has been used together with LabVIEW. During spring 2002, the SHIPTRAP specific add-ons will be implemented. The commissioning of the first version of the overall system is planned for summer 2002.

[1] http://www-wnt.gsi.de/steppercavea
[2] http://www.ni.com
[3] http://www.movtec.de
[4] http://www.ief-werner.de
[5] http://www.profibus.com
[6] http://www.comsoft.de
[7] http://www.siemens.de
[8] http://www.beckhoff.de
[9] http://www-wnt.gsi.de/shiptrap
[10] http://www.objectview.de/english/index.htm