EDOC403

EXOGAM PROJECT

Exogam HV Control Specification

Edition 1.2

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1 Introduction

The detector array proposed by the Exogam project will consist of 16 segmented clover detectors. Each clover detector consists of 4 germanium (Ge) crystals surrounded by a shield of bismuth germanate (BGO) and caesium iodide (CsI) crystals.

In order for the clover detector to operate, each crystal needs to be maintained at a high voltage (HV) level specified by the manufacturer. For the Ge crystals in particular, this voltage should not be applied or removed instantly but at or below a specified rate. In addition the Ge crystals need to kept very cold when voltage is on. Failure to deliver the voltage under these conditions can result in the crystal structure being damaged.

It is proposed to use a computer controlled HV supply for the Ge crystals and to control the voltage on each crystal individually. The shield will have one HV supply common to all elements in the shield fed via a distribution box. At present it has not been decided whether the distribution box will be completely decoupled from the computer controlled system and have it's own HV supply, or whether it will be fed via the computer controlled supply.

The control system will allow voltages to be set, monitored and restored from a database via a graphical user interface. The Exogam array will reside in a restricted-access radioactive area so HV control will be possible via a remote terminal.

The temperature of the Ge crystals will be controlled by an automatic liquid nitrogen filling system.

2 Hardware

The system will comprise a CAEN SY527 universal multichannel power supply system controlled via a CAEN A303 high speed serial CAENET IBM PC interface.

The power supply is rack mounted and has slots for up to 10 channel boards. The Ge voltage will be fed via 6 CAEN A832P[1] boards containing 12 channels each. The BGO voltage will be fed via a single A734P board containing 16 channels. The interface will reside in an industrial rack-mounted PC chassis next to the SY527 power supply. The controlling software will run in the rack-mounted PC.

For the first phase of Exogam due by the end of 1998, it is likely that 2 Exogam clovers and 4 Euroball clovers will be used. Each Exogam clover requires 4 HV Ge channels, and each Euroball clover requires 1 HV Ge channel. For the proposed final detector array of 16 segmented clover detectors, when the maximum number of channels will be required, one SY527 crate will be required. If yet more channels are required at a later date, further CAEN or LeCroy HV power supplies can be added to the system.

No decision has yet been reached on the shutdown signal specification. Euroball clover detectors maintain a -24V shutdown signal in normal operation changing to 0V in the event of a trip. This specification may also be implemented for the Exogam clovers if timescales allow. Alternatively a trip signal of +5V dropping to ground will be implemented since this can then be used directly to shut off the voltage on a given Ge channel by feeding it into the TRIP connector for that channel on the A832 board. Whichever voltage level is defined, the hardware shutdown mechanism will be designed so that if a trip signal is generated from one Ge preamplifier it will shut down the Ge voltage for the whole clover detector. If a channel trips in this way then the voltage is ramped down to zero at the maximum ramp-down rate set in software.

3 Software

The controlling software will run under a linux operating environment. It will consist of a control task to issue commands across the high speed serial link. This task will be able to interrogate each power supply to find out which board type is present in each slot so the system will be self-configuring to allow the boards to be placed in any slot.

[1]Polarity to be confirmed

A setup file configurable by the user will map each possible HV line required to a unique module, slot and channel combination. This is known as the wire list.

A graphical user interface (GUI) running in the PC locally or via a restricted access remote session will allow the user to control the voltage on each channel.

Both CAEN boards allow the following parameters to be set for each channel:

- on/off status
- requested voltage (*demand voltage*)
- voltage limit (overrides requested voltage)
- current limit
- rate of change of increasing voltage (*ramp-up rate*)
- rate of change of decreasing voltage (*ramp-down rate*)

It is proposed to allow all these parameters to be set via the user interface and saved in a database, but to make clear in the software that certain parameters should be modified by expert users only. The control task will monitor each channel to see if any parameters have been changed and automatically save any changes to the database. It will be possible to selectively restore parameter values from the database.

When a detector is added to the system the GUI will require the user to specify the parameter values for each channel. The user will be able to select a set of default values for a given detector type.

The control task will also monitor the state of each channel to check for any irregularities. If a channel trips then the user will be alerted via a warning message. There will also be an optional audible alarm the user can enable to indicate a trip has occurred. The channel will be switched off and only be reactivated by user intervention.

The GUI will be written in Tcl/Tk to be compatible with the MIDAS software that may be used for the data acquisition system. On startup it will display the system status in terms of the number of active Ge and BGO channels. A quick reference summary of the voltage on each channel will also be displayed in a histogrammed format. The control task will constantly check if any voltages do not match the demand voltage for each channel and any anomalies will be displayed as a colour coded warning. Information on the corresponding crate, channel and slot will be available via a secondary window. More detailed information on all Ge channels, all BGO channels and all channels for a single detector will be displayed in separate windows, accessible by clicking on the relevant button in the startup window. This information can be displayed in a tabulated or histogrammed format. If the user wishes to change a parameter, they will have the option of changing it for a single channel, detector or all detectors of the same type.