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EUROGAM PROJECT

NSF DATA ACQUISITION SYSTEM

The Eurogam Data Acquisition System
An Overview

Edition 1.1
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NSF Software Systems Group
UK Science and Engineering Research Council
Daresbury Laboratory

Overview of the Eurogam Data Acquisition System

V Pucknell

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1 Introduction

The data acquisition and analysis system for Eurogam is divided into a number of component sub-systems as described in the block diagram. Each sub-system is a logical component which performs a self contained function but does not necessarily by itself equate to a physical hardware component. Each sub-system has a well defined function described briefly in this document. Further documents define in detail the specification of each sub-system and the software protocols which describe its external interface.

As long as the external interface is maintained any particular sub-system can be developed to take advantage of changes in technology without effecting other sub-systems. In some cases a number of implementations of a particular sub-system may exist to suit the local requirements of a given laboratory. As long as the specification of the sub-system is fully supported and the external interface maintained then all other sub-systems will function without the need for alteration.

This approach allows a very flexible system to be produced which can respond to the changing requirements of the experimental program and take advantage where appropiate of changing technologies both with minimal impact on the system as a whole. In addition variations on the system can be easily implemented as required by the host laboratories and the University collaborators. It should be noted that the latter will each require implementations of a subset of the system for data analysis.

In keeping with the nature of the general system approach the function of specific sub-systems make no statement about implementation or hardware. The block diagram shows the component sub-systems and the direction of control paths linking the sub-systems. Data may flow in either direction on a sub-system link but control is only in the direction indicated.

2 The Sub-Systems

2.1 The Event Builder [1]

This sub-system receives data from the front-end electronics, constructs complete events in the standard external format and builds blocks of events for subsequent processing. A number of streams of data blocks may be generated each containing different groups of events in order to simplify or improve performance of subsequent processing.

The sub-system receives control information from the acquisition control sub-system [6] and outputs event blocks to the event processing sub-system [2].

2.2 Event Processing [2]

This sub-system receives blocks of events from the event builder sub-system [1] and processes the data in accordance with instructions received from the acquisition control sun-system [6]. All or a reconstructed subset of the received data is passed on to the data storage sub-system [3]. In addition the acquisition control sub-system [6] may request sets of the processed data for monitoring purposes and eventual presentation to the user.

2.3 Data storage [3]

This sub-system is required to store event data received from the event processing sub-system [2] onto permanent storage media. While the bulk data is received from the event processing sub-system control information which specifies the data paths and selects the required storage medium plus other data for storage is received from the acquisition control sub-system [6].

The sub-system will handle multiple streams of data each directed to a different storage medium.

For subsequent data analysis the data storage sub-system will on demand supply the event processing sub-system [2] with event data previously stored.

2.4 Electonics Setup, Control and Diagnostics [4]

This sub-system handles the setup of the front-end electronics. It receives control information from the acquisition control sub-system [6] and performs all functions necessary to set data acquisition running.

An additional function is to provide diagnostics facilities both via the acquisition control sub-system and via a dedicated interface for maintenance of the hardware. Functions are provided to enable diagnosis of faults and ensure a short mean-time-to-repair (MTTR).

2.5 Experimental Equipment Control [5]

This sub-system controls and monitors experimental equipment associated with the system. Some items may be closely related to the acquisition system and control information is received from the acquisition control sub-system [6] while other items are indirectly related and control information is received from the experimental control sub-system [7].

The external interface to this sub-system is required to be particularly general purpose since the items to be handled are varied and will change with time.

2.6 Acquisition Control [6]

This sub-system coordinates the acquisition functions of the system. It receives control information from the experimental control sub-system [7] and communicates with the relevent sub-systems [1] - [5] necessary to execute the requested task.

Once data acquisition has been setup by the experimental control sub-system [7] and is running then this sub-system will continue to control acquisition of data without need for further input unless an unusual event occurs which requires action on the part of the user.

Requests from the experiment control sub-system [7] for data for experimental monitoring will be received periodically and these will be satisified by obtaining the necessary data from sub-systems [1] and [2].

2.7 Experimental Control and Data Analysis [7]

This sub-system handles all user input received from the graphics sub-system [8]. Input requests associated with data acquisition are analysed and the appropiate requests passed on to the acquisition control sub-system [6] for execution. Monitoring of data acquisition and in particular acquisition of histograms occurs via the acquisition control sub-system [6] to which requests are passed for the required data.

This sub-system performs all analysis functions on acquired data (with the exception of the event processing carried out by [2]) both in real time for the current experiment and for post experiment analysis sessions. It is responsible for storage of all data other than event data handled on-line by [3].

Implementation is in a form which allows expansion of facilities without limit and enables users to easily include private functions into the system in a consistent manner.

Control and monitoring of experimental equipment not directly related to data acquisition will be via direct communication with the experimental equipment control sub-system [5].

All presentation of information to the user and interaction with the user will be via a two way dialogue with the graphics sub-system [8].

2.8 Graphics [8]

The graphics sub-system has a two-way dialogue with the experimental control sub-system [7]. This dialogue describes the graphics functions at a very high level in terms appropiate to the requirements of the system. By removing conventional graphical interfaces and libraries from the data analysis functions we :-

1) remove the requirement for each and every analysis function to include conventional graphics interfaces thus preventing duplication of effort since may functions require similar garphical facilities.

2) Ensure a consistent presentation and user interface across all functions.

3) Since major graphical functions (such as histogram display and manipulation) need only to be implemented once we can afford to expend effort to achieve the best possible result.

As with other sub-systems as long as the external interface is maintained the graphics sub-system can be changed without effect on the rest of the system.

2.9 Communications [9]

The communications lines within the system are considered to be off sufficient importance to warrant being classified as a separate sub-system. In fact it is expected that some of the communications lines will change with time to take advantage of improving technologies. At any time not all communications lines need to be of the same technology. The purpose of a communications line is to move data from point to point and as long as this is achieved by any given technology then we can replace that line without effecting the rest of the system.

The external interface to the communications sub-system is technology independent while all interfaces and protocols which must be dependent on the technology are internal to the sub-system.