CAPTAN

A MODULAR DATA ACQUISITION SYSTEM

The Fermilab Computing Division develops creative solutions in support of research.

1 SUMMARY OF CAPTAN

1.1 From the very big to the very small

Fermilab Computing Division provides support for research from the sub-atomic level to the cosmic level. Equipment is needed to acquire, analyze and store large data sets.

1.2 Solving common problem in general way

There are diverse experiments generating data. CAPTAN is intended to solve a problem these experiments have in common. The initial capture and low level processing of data for transmission to analysis farms and storage facilities.

1.3 CAPTAN is a modular system

The CAPTAN system is designed to be flexible in its capabilities and modular in its construction. There are three types of modules:

Analog I/O

Digital processing

Power control

These are designed to be combined as needed, in a highly scalable configuration for each experimental application. An entire system may be run from one power supply. The basic modules will interface with custom cards having a digital I/O range of 1.5V to 3.5V.

Provision is provided for a free space optical link between cards for high speed communication.

2 DESCRIPTION

2.1 Data Conversion Board

2.1.1 Description

The Data conversion board supports a wide range of I/O channels. Both high resolution and fast ADC/DAC.

There are on-board programmable power supplies to power or control external analog circuitry: Including a high voltage supply.

Connectors for custom I/O boards and SATA devices are provided.

Provision is made for an on-board FPGA.

2.1.2 Specs

8 channels of ADC. 65 MSPS per channel. 12 bit resolution. Differential inputs. 1.4 Volt Max.

2 channels of ADC. 1 GSPS per channel. 8 bit resolution. Differential inputs. 2V Max.

2 channels of DAC. 500 MSPS per channel. 12 bit resolution. Differential output 2ma to 20ma.

32 channels of slow speed DAC. 16 bit resolution. 0-3.3V @ 5 ma.

Sparten 3E FPGA. 250K gate array. 260Kb RAM.

Two SATA connectors.

Five user controlled regulated positive supplies. .5 to 3.5 volts @ 2 AMP

One user controlled regulated supply. +28V to -28V @ ½ AMP

One user controlled switching regulator +3.5V to -3.5V @ 3.4 AMP

One high voltage supply +/-1000V @ 1.2 ma

Connectors for up to four custom I/O cards.

2.2 Node Controller Board

2.2.1 Description

The Node Controller Board is intend as a programmable digital processing module. The module is designed to provide a flexible range of FPGAs, an LCD display and has daughter card connectors.

2.2.2 Specs

Footprint for seven different Xilinx Vertex 4 FPGAs.

Provision for LCD display.

One daughter card connector for Gigabit Ethernet interface.

2.3 Power Distribution Board

2.3.1 Descripton

This module is intended as a programmable power source for external devices. It can be used as a analog power supply or motor control. The intention is to provide control for equipment that requires significant power.

2.3.2 Specs

8 power output transistors capable of sourcing up to 7 AMPs.

8 high speed output transistors. 30v @ 1 AMP output.

2.4 Software

2.4.1 FPGA Programmability

Commercial software is available for programming the FPGAs

2.4.2 Readout and event display

In-house software has been developed for readout and display of events for the pixel telescope application. This software is Windows based and scalable.

2.4.3 Graphical user interface

A GUI is available to use for test stands which can control and readout the models through the digital board.

3 EXAMPLES OF USE

3.1 VIP study

Gregory Deptuch
Test stand example

3.2 Fermilab Test Beam Facility

Eric Ramberg
Beam Telescope

3.3 IHEP Strips Telescope

Marcel Demarteau