PHENIX Muon Tracker
ARCNet Interface

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March 7, 2000

1. Introduction

Each Front End Module (FEM) in the PHENIX Muon Tracker contains an ARCNet daughter card. ARCNet is responsible for several different tasks within the FEM:

1) Configuration of the CPA chips.
2) Configuration of the AMU/ADC chips.
3) Control of the FPGA serial string.
4) Provide ability to reset the FPGA.
5) Program the FPGA EPROM.
6) Communicate with DALLAS monitoring chips.

I will describe each of these functions, explain the current status of the implementation of these functions, and cite any action that needs to be taken at this time.

2. Configuration of CPA chips

Each PHENIX muon tracking FEM contains one controller card and two cathodes read out cards (CROC), labeled CROC A and CROC B. Each

CROC has 8 cathodes pre-amp (CPA) chips which receive configuration data via a serial bit chain. Each CPA chip has 34 configuration bits, as outlined in the draft of the Muon Tracker Preamp User's Data Sheet (author M.S. Emery). Thus, the entire CPA serial string for one CROC is 8 x 34 = 272 bits long. The 34 bits in one CPA are divided into five units as follows:

6 bit Output Offset Control block
6 bit Injection Level DAC block
6 bit Preamp Baseline Restore DAC block
8 bit Preamp Reset block
8 bit Preamp Inject Enable block

Loading of the serial string is done by a simple alogorithm of addressing the CPA configuration string on the desired CROC board, setting the data in line to the desired state, clocking it in with the serial clock, and latching the data in with the data clock.

Status: We have successfully used the CPA serial string to configure the prototype electronics.
Action: No further action is needed at this time.

3. Configuration of AMU/ADC chips

Each CROC board in an FEM contains two Analog Memory Unit/Analog Digital Convertor (AMU/ADC) chips. The AMU/ADC chips are configured in a similar way as the CPA chips. Each AMU/ADC chip has 33 configuration bits, as outlined in AMUADC Test Specifications - Rev. 2 (author M.S. Emery). Thus, the entire AMU/ADC serial string for one CROC is 2 x 33 = 66 bits long. The 33 bits in one AMU/ADC are divided into seven units as follows:

6 bit MUX2 Control Block
1 bit Correlator Select Control
6 bit Reference Voltage Control Block
6 bit Correlator Voltage Control Block
6 bit Reference Current Control Block
2 bit MUX-HIZ Pull-down Control Block
6 bit MUX1 Control Block

Loading of the AMU/ADC serial string is identical to the CPA string, with the obvious exception that you must address the AMU/ADC serial string on the desired CROC.

Status: We have successfully used the AMU/ADC serial string to configure the prototype electronics.
Action: No further action is needed at this time.

4. FPGA Serial String

Each Controller board in an FEM contains one FPGA. The FPGA can receive configuration instructions via a serial bit string. Currently, the serial string is used to configure which AMU/ADCs and which channels to read out. At this time, the string is ten bits long, constructed as follows:

4 bit AMU/ADC Readout Control Block
6 bit Channel Readout Control Control

Loading of the FPGA serial string is identical to the CPA and AMU/ADC strings, with the obvious exception that you must address the FPGA serial string.

Status: We have successfully used the FPGA serial string to control readout of specific AMU/ADCs on the prototype electronics.
Action: Add bits to FPGA serial string as development of FPGA code progresses. This would require only trivial changes in the ARCNet code.

5. FPGA Reset

ARCNet can issue a reset signal to the FPGA. This is done by simply toggling the reset line.

Status: We have successfully issued an FPGA reset signal with the prototype electronics.
Action: No further action is needed at this time.

6. FPGA EPROM Download

ARCNet must provide the ability to load the FPGA EPROM to allow for in-system programmibility. Currently, the FPGA EPROM is an EPC2 device utilizing a JTAG interface. There are two main tasks for ARCNet: retrieve the configuration file from outside the FEM and store it in the ARCNet board microcontroller memory, and then load the file into the EPROM using the JTAG protocol.

Status: Attempts to program the FPGA EPROM have been unsuccessful. The issue has been raised about whether it makes sense to continue trying, or to switch to an Atmel EPROM which eliminates the complicated JTAG interface.

Action: Make a decision to use EPC2 or Atmel device, then continue programming attempts.

7. DALLAS Monitor Chips

Each FEM contains seven DALLAS 2437 monitor chips and one DALLAS 2480 one-wire bus master chip. The 2437 chips are used to measure currents, voltages, and temperatures on the FEE boards. These chips receive configuration data and send measurement data via a one-wire interface, called the DALLAS μLAN. The 2480 bus master chip converts the standard serial port bitstream from the ARCNet daughterboard microcontroller to the one-wire signal protocol required by the 2437 chips.

Status: We have successfully communicated with the DALLAS chips. Chip serial numbers, currents, voltages, and temperatures have all been read out using the prototype electronics.

Action: No further action is needed at this time.

8. Software

ARCNet software can be divided into two parts: embedded software and user software. Embedded software is programmed into the ARCNet board microcontroller ROM and controls the microcontroller pins to provide the services described above. The embedded sofware is programmed in the C language, compiled with an 8051 C-compiler, converted to a HEX file, then downloaded to the ARCNet board ROM. The user software must take input from a user concerning how to configure the electronics and construct an ARCNet message to be sent over the network. The user software and the embedded software are NOT independent, because they must agree on how commands and data are to be structured within the ARCNet packet. Currently, the user software consists of a C program which generates arcnet packets. This program is intended only for testing purposes, and does not interface to the PHENIX ARCNet Corba server. The final user software will likely use Java programming and graphical user interface tools. A Java program which interfaces to the ARCNet Corba server has been obtained from the Drift Chamber group, it must be modified for Muon Tracker purposes.

Status: Embedded software development is well underway and will not need modification to be implemented in the final system. User software exists for testing purposes and is currently in use.
Action: Write user software in Java that can interface to the ARCNet Corba server.