

Slow Control for EMU Electronics

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Need for Slow Control to Crates:

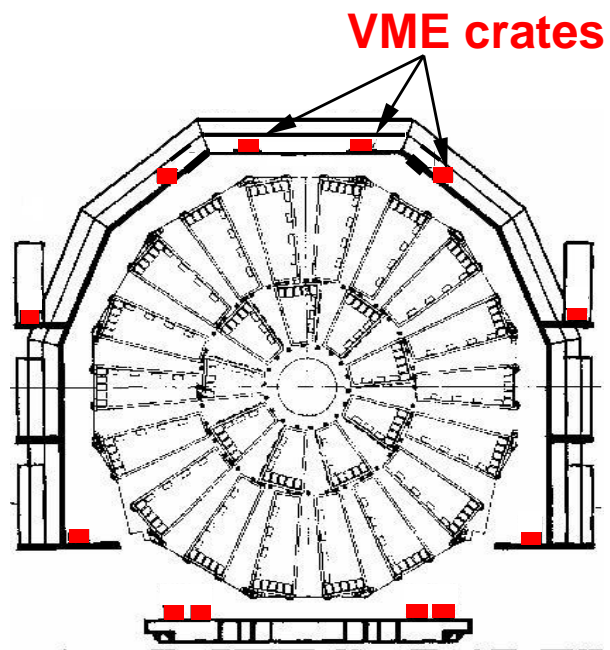
- Download FPGA's via serial line JTAG on crate cards
- Download Shift Registers from crate cards to FE Boards via JTAG
- Read ADC's (temp, voltages), Load DAC's
- Read and Write memories on crate cards

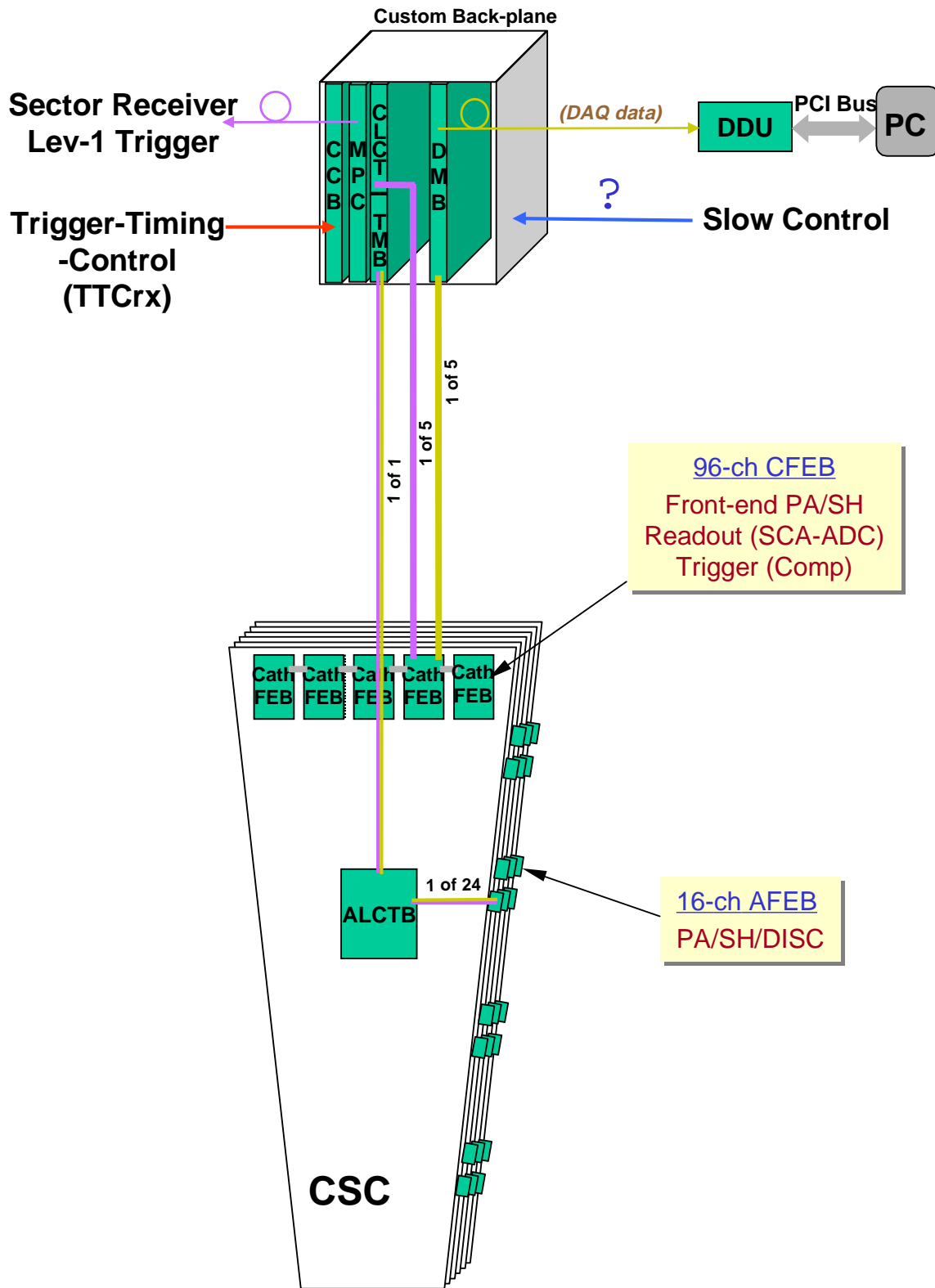
Crate Count

20 Cards/Sector
1 VME Crate/Sector

Total Crates:

12X2 for ME1 Disk
12x2 for ME2,3 Disk





Solution 1 - CANBUS

(for overview

http://algonet.se/~staffann/developer/CAN.htm#what_is_can)

- **Used in cars to talk to embedded CPU's**
- **Serial twisted pair bus**
- **1 Mbit/s over 40 meters**
- **12 Bit Addresses/ 12 bit Masking**
 - **equivalent to Broadcast, multi-Broadcast**

Possible System

- **One PC serves 12 crates**
- **3 CANBUS - PCI (4-port) cards**
- **12 CANBUS cables/PC**
- **each sector card has embedded CPU**

Many cheap processors have CANBUS built inside chip (for list see <http://www.can-cia.de/cp.htm>)

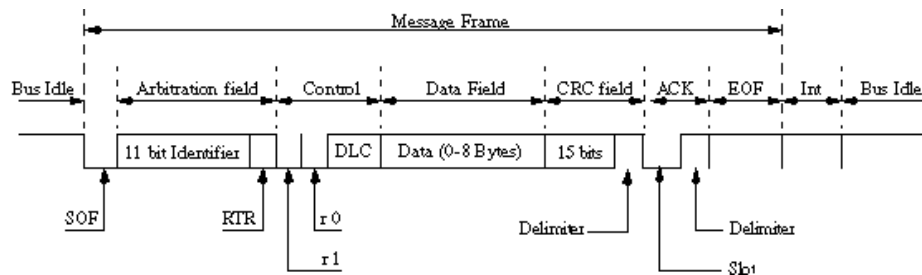
Philips p83c591 8-bit \$7.95

TI TM S320F243 16 bit DSP \$17.45

Approximate Cost:

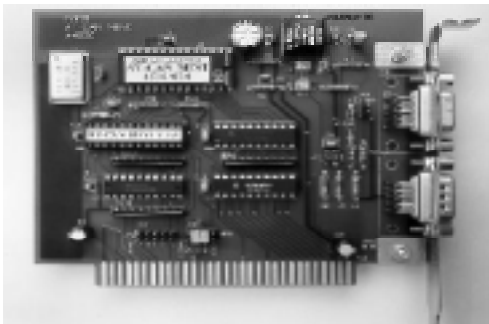
4 PC 's	\$ 4,000
12 PC IC ards	\$ 2,400
960 em bedded processors	\$ 29,800
C ables	\$ 5,700
Total	\$ 45,900

Problem: Slow



Headers are a significant loss

CAN test at Ohio State



2 Port AT-CAN-MINI

2 300 M H z PC 's

L inux Lab Project CAN drivers

Write (PC1 to PC2) 400 Kbit/s

Write-Read (PC1 to PC2) 80 Kbit/s

(better drivers may exist)

- Embedded processors (960 in system):
- machine code or C ? debuggers ?
 - do we all use the same processor ?

Solution 2 - (Much Better)

A cheap embedded VME controller

Dynatem D360 @ \$731 (100 piece quantity)



- 25/33 MHz 68EN360 Communications Controller with Built-in CPU32+; Processing Core, I/O, and Memory Interface
- Ethernet via 10BaseT or AUI
- 4 MB of 32 bit Wide DRAM
- 2 or 4 MB Flash PROM
- 256 KB or 1 MB of Dual Ported NV SRAM
- VME bus Slot 1 Capability

Possible System

- One PC serves 24 crates
- Ethernet 10 Base-T
- VME Bus with in Crate
- Each board has VME interface (FPGA)

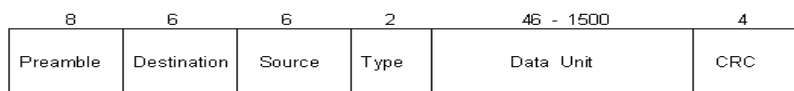
Approximate Cost:

2 PC 's	\$ 2,000
48 VME Controllers	\$ 35,088
960 VME interfaces	\$ 33,600
Cables + Hubs	<u>\$ 2,500</u>
Total Cost	\$ 73,188

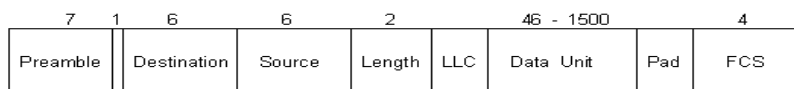
Software:

OS-9 or VXWORKS Debugger Support

For Speed (10 M bits/s) Ethernet Packets must be large



DIX Ethernet Packet



IEEE 802.3 Frame

software will unpack data and generate VME signals

Ethernet-VME system is clearly superior

- **10 times speed of CANBUS**
- **hardware we are use to**
- **software simpler to use**

- **At Ohio State we are working on a XILINX VME interface**
 - **16 bit read/write**
 - **JTAG serial**
- **We will purchase a Dynatem D360**