

Multiplicity Vertex Detector Silicon and Electronics Components

Jehanne Simon-Gillo
Los Alamos National Laboratory
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This is a growing document and is subject to change.

1. Silicon Detector Mechanical Assemblies

1.1 Rohacell C cages:

- Lead Engineer = Jan Boissevain
- Vendor = Rohm Tech
- 24 total, 12 per MVD half
- Machine 50 good cages
- 25 spares
- Cages sealed with 0.5mil Parylene
- Silicon detectors glued to cages
- Fully populated houses 3 inner and 3 outer detectors
- Partially populated houses 3 inner and 1 outer detector

1.2 Silicon Strip Detectors:

- Lead Engineer = Jon Kaustinsky
- Vendor = Micron Semiconductor
- 112 detectors total
- 256 channels/detector x 112 detectors = 28,672 channels
- Inner detector = 72 + 20 spares = 90
90 x \$1200/det = \$110,400
- Outer detector = 40 + 12 spares = 52
50 x \$1500/det = \$78,000

1.3 Silicon Pad Detectors:

- Lead Engineer = Jon Kapustinsky
- Vendor = Micron Semiconductor
- 12 Pad detectors per endcap x 2 endcaps = 24 Pad detectors
- 24 detectors x 252 channels/detector = 6048 channels
- 24 + 6 spares = 30 total
- 30 X \$1750 = \$52,000

1.4 Kapton Cables:

- Lead Engineer = Jan Boissevain
- Vendor = Litchfield Inc
- Cable is glued then wirebonded to Silicon detector and MCM
- 6 silicon strip detector species x 1900NRE/species
- Inside/Bottom cable
 - 24+16 spare @ 30.85/cable
- Inside/Middle cable
 - 24+16 spare @ 37.20/cable
- Inside/Top cable
 - 24+16 spare @ 57.25/cable
- Outside/bottom cable
 - 24+16 spare @ 27.75/cable
- Outside/Middle cable
 - 8 + 7 spare @ 78.5/cable
- Outside/Top cable
 - 8+7 spare @ 98.5/cable
- Silicon Pad Detector cable or transition board
 - 1900NRE + 24+16spare @ 100/cable

2.0 Front-End Electronics

2.1 Multi-Chip Module

- Lead Engineer = Jon Kapustinsky/Gary Richardson
- Vendor = Lockheed Martin
- 112 Strip Detectors + 24 Pad Detectors = 136MCM
- With detector spares = total of 172 detectors
- Fabricate 200 MCM
- 256 channels/MCM
- 19 die/MCM : 8 preamp, 8AMUADC, 2 Heap Manager, 1 OPAMP

2.1.1 MCM Output Cable:

- Lead Engineer = Jan Boissevain
- Vendor = Litchfield Inc?
- Cable is glued then wirebonded to MCM
- Cable is attached via connector to power communication cable.
- One MCM output cable per MCM = 200 output cables.
- 50 spares
- 250 x 50\$/cable = \$12500

2.2 Electronic Die

2.2.1 TGV32

- Lead Engineer = Chuck Britton
- Vendor = ORBIT
- Need to instrument 200 MCM @ 256 ch/MCM = 51200 (includes spares)
- 32 channel/preamp die
- Assume 50% yield from ORBIT
- $51200 \text{ ch} \times 1 \text{ die}/32\text{ch} \times 1/0.5 \text{ yield} = 3200 \text{ die}$
- ORBIT quote = \$65000

2.2.2 AMUADC32

- Lead Engineer = Mike Emery
- Vendor = MOSIS
- Need to instrument 200MCM @ 256 ch/MCM = 51200 (includes spares)
- 32 channel/ AMUADC die
- Assume 50% yield from process
- $51200 \text{ ch} \times 1 \text{ die}/32\text{ch} \times 1/0.5 \text{ yield} = 3200 \text{ die}$
- HP/MOSIS quote = \$50000 (Common FEE)

2.2.3 Heap Manager

- Lead Engineer = Nance Ericson
- Vendor = Chip Supply (Joey Mahey)
- 2 Xilinx 4010-E FPGA/MCM x 200 = 400 4010-E FPGA
 - $400 \times 132\$/4010 = 52800\$\$

2.2.4 OPAMP

- Lead Engineer = Chuck Britton
- Vendor = National/Comlinear
- Model = CLC426
- 1 multiplicity sum driver/MCM = 200 Multiplicity sum OPAMPS
- $200 \times 2\$/\text{opamp} = \400

3.0 Power/Communication Cable, Motherboard, Daughterboard

3.1 Motherboard

- Lead Engineer = Kevin McCabe/Jan Boissevain
- Vendor =
- 8 layer board
- (2 boards+2spare) x 2 species = 8 total; Instrument half of spares so 6B
- 3K NRE + 1000\$/B + 1Kstuff setup+200\$/B
- 1 board services 42 MCM fully populated or 34 MCM partially populated.
- Components
 - LDO
 - LDO for MCM power filtering - 5 LDO associated with 1 DC Pow conn
 - Vendor = Micrel
 - Model =
 - 35LDOs/B x 6B x 5\$/LDO
 - Polyswitch resettable fuses
 - Vendor = Raychem
 - Model =
 - 20 per DC connector
 - 20 fusesx 7conn/B x 6Bx1\$/fuse
 - ADC
 - Vendor = Maxim
 - Model = 8ch serial 12 bit ADC
 - ADC for monitoring of MCM temperature sensor
 - 10ADC/B x 6B x 10\$/ADC
 - Multiplexers
 - Vendor = Analog Devices
 - Model = ADG406 16chan analog multiplexer
 - for spy channels, signals, T,V; has 8 channels
 - 6Multiplexers/B x 6B x 10\$/ea
 - Serial link + glue logic
 - Vendor = ?
 - Model = ?
 - To read out ADC and control multiplexer
 - 1 serial link/B x 6B x 25\$/link
 - PECL clock synthesizer and fanout
 - Vendor = Synergy
 - Model of synthesizer= SY89429-A
 - Model of fanout = SY10E111
 - 1 synth and 1 fanout per board
 - 1+1Pecl/B x 6B x 10\$/ea

- Motherboard Connectors:
 - LVDS headers
 - Vendor = 3M
 - Model = 3M81036-660X0X
 - Maps to Power Communication cable (data out of MCM)
 - Connects to DCMIM cable
 - 36 contacts
 - 7 LVDS headers/B x 6B x 10\$/header
 - DC Power connectors
 - Vendor = Panduit
 - Model =
 - Panduit MAS-CON IDC: 10contact, 8A, (0.156pitch), 18 gauge wire
 - Header (MLSS156-10TA): 31.7mmx3.7mmx3.2mm
 - Right angle Plug (CT156F18-10): 31.7mmx0.9mmx19.6mm
 - Comes from Power Distribution Box
 - Maps to Power Communication Cable
 - 1 Provides power to 6 MCMs
 - 7 DC Power connectors x 6B x 1\$/conn
 - Timing and Control Connector
 - 40 contact
 - Vendor = 3M
 - Model = 3M81040-660X0X
 - 7/B x 6B x 10\$/header
 - Silicon HV connector
 - 1 50 contact + 1 40 contact
 - Vendor = 3M
 - Model for 40 contact = 3M81040-660X0X
 - Model for 50 contact = 3M81050-660X0X
 - 2/B x 6B x 10\$/header
 - Trigger Interface connector
 - Discriminator analog sum output goes to trigger interface module
 - 50 contact
 - Vendor = 3M
 - Model = 3M81050-660X0X
 - 1/B x 6B x 10\$/header
 - Power Communication Cable Connector
 - Vendor =JAE
 - Model =JAEKX14-160
 - Connects to Power Communication Cable
 - 160 Contact Connector
 - 6conn/B x 6B x 10\$/conn
 - Daughterboard connector
 - Vendor =Samtec
 - Model=SFM - 140-0180
 - Connects to daughterboard
 - 2 - 80 contact connector for total of 160 contacts
 - 2H/B x 6B x 10\$/H

3.3 Power/Communication Cable

- Lead Engineer = Kevin McCabe/Jan Boissevain
- Vendor = ?
- Rigid Flex board
- 1 cable per 6 MCM
- 2 species x (12+3spares) = 30 cables
- 1k NRE x 2species + 800\$/cable + 1K stuff setup + 50\$/B stuff x 30B
- Capacitors
 - For Silicon bias:
 - Vendor =
 - Model =
 - 6/cable x 30cab x 10\$/cap
 - For comparator:
 - Vendor =
 - Model =
 - 6/cab x 30cab x 1\$/cap
 - For something else:
 - Vendor =
 - Model =
 - 6/cable x 30cab x 1\$/cap
- LVDS translator
 - Vendor =National Semiconductor
 - Model= DS90C031
 - 6/cab x 30cab x 10\$/lvds
- Pecl clock fanout
 - Vendor=Synergy
 - Model=SY10E111
 - 1/cab x 30cab x 10\$/pecl
- Dual OPAMP
 - Vendor =?
 - Model=?
 - Buffers spy channel output. Needs to be as close to MCM as possible as AMU has no driving capability.
 - 1 opamp/MCM x 6MCM/cable x 30cable x 10\$/opamp
- Connector from MCM output cable to Power Communication Cable
 - 2 connectors per MCM output cable - 1 analog, 1 digital
 - Vendor = Elco
 - Model # 08-6212-024-001-000
 - 24 contact 0.5mm pitch, surface mount horizontal ZIF, 0.4A,
 - 30 cables x 2conn/cable x 2\$/each (1000min) = 2000\$
- Connector from Power Communication to Motherboard
 - Vendor =JAE
 - Model =JAEKX15-160-NLNL
 - 160 contact
 - 1conn/cable x 30cab x 10\$/cable

3.4 Daughterboard

- Lead Engineer = Kevin McCabe/Jan Boissevain
- Vendor =
- 1 daughterboard services 6 endcap MCM
- 4 boards total + 4 spares = 8 total boards
- Capacitors
 - For Silicon bias:
 - Vendor=?
 - Model=?
 - 6/cable x 8B x 10\$/cap
 - For comparator
 - Vendor =?
 - Model=?
 - 6/cab x 8B x 1\$/cap
 - For something else:
 - Vendor=?
 - Model=?
 - 6/cable x 8B x 1\$/cap
- LVDS translator
 - Vendor= National Semiconductor
 - Model= DS90C031
 - 6/cab x 8B x 10\$/lvds
- Pecl clock fanout
 - Vendor= Synergy
 - Model= SY10E111
 - 1/cab x 8B x 10\$/pecl
- Dual OPAMP
 - Vendor =?
 - Model=?
 - Buffers spy channel output. Needs to be as close to MCM as possible as AMU has no driving capability.
 - 1 opamp/MCM x 6MCM/cable x 30cable x 10\$/opamp
- Connector: daughterboard to motherboard:
 - Vendor=Samtec
 - Model=TFM-140-11-S-D 80
 - 2 - 80 contact connectors per board
 - 2H/B x 8B x 10\$/H
- Connector from MCM output cable to Power Communication Cable
 - Vendor=Elco
 - Model # 08-6212-024-001-000
 - 2 connectors per MCM output cable - 1 analog, 1 digital
 - 24 contact 0.5mm pitch, surface mount horizontal ZIF, 0.4A
 - Cost included in Power communication cable connectors

4.0 Interface Modules

4.1 Timing and Control Interface

- Lead Engineer= Mike Emery
- Vendor = ?
- 8 boards + 4 spare + 1 cleantent = 12 total
- 4 layer board , 9U, 1 board set
- 3.5K NRE + 1000/B x 12B
- Stuffing costs = 1Ksetup +(200\$x12)
- Connector for cable from Motherboard (1 motherboards fanned to 2 T&C)
 - Vendor=3M
 - Model=82040-6006
 - 7conn/B x 12B x 10\$/conn
 - 40 contact connector
- Connector on VME crate
 - P1 connector
 - Vendor=?
 - Model=?
 - 3conn/B x 12B x 10\$/B
- Cable from Motherboard to T&C
 - Vendor= 3M
 - Model= 90101-40
 - 7 cables/Moth x 1 moth/2TCIM x 12TCIM x 16.4ft/cable x7\$/ft
- 1 Glink receiver/B x 12B x 250\$/Glink
 - Consists of GLINK chip and optical driver
 - Vendor for chip = HP; vendor for driver = Methode
 - Model= TTL GLINK receiver
- X ARCNET rec/B x 12B x 80\$/arcnet
 - Vendor=?
 - Model=?

4.2 Data Collection Interface

- Lead Engineer = Nance Ericson/Mark Allen
- Vendor=?
- 4 layer board
- $28B + 7sp = 35B$
- $3K\ NRE + (35B \times 600\$/B) + 1k\ stuff\ setup + (35B \times 200\$/B)$
- FPGA
 - Vendor= Chip Supply
 - Model= 4005
 - $6\ FPGA/B \times 35B \times 50\$/FPGA$
- Glink transmitter
 - Vendor=?
 - Model=?
 - $3\ Glink\ /B \times 35B \times 305\$/trans\ ($
- Connector on VME crate
 - Vendor=?
 - Model=?
 - $3\ conn/B \times 35B \times 10\$/B$
- Cable from Motherboard to DCMIM
 - Vendor=3M
 - Model=90101-36
 - $1\ cables/\ DCM \times 35DCM \times 16.4ft/cable \times 7\$/ft$
 - Connector on both sides of cable
 - Vendor=3M
 - Model=82036-6006
 - $2\ conn/cable \times 35\ cab \times 10\$/conn$
- FIFOs
 - Vendor = Integrated Device Technology
 - Model = IDT72831
 - $6FIFO/B \times 35B \times 30\$/FIFO$
- Buffers
 - Vendor = Motorola TI
 - Model = SN74ACT16827DL
 - $6\ Buffers/B \times 35B \times 10\$/buffer$

4.3 Trigger Interface

- Lead Engineer = Nance Ericson
- Vendor =
- 4B + 4sp = 8 total
- 4 layer board
- 1 board per 24 multiplicity sum
- 3.5KNRE + (8B x 800/B)
- stuff: 1Ksetup + (8 x 200)
- ADC
 - Vendor= Analog Devices
 - Model= AD 876GR
 - 24ADC/B x 8B x ?\$/ADC
 - 1 ADC per trigger sum
 - 7.5bit @ 10mHz, 10bit converter, send 8 bits to trigger system
- FPGA
 - Vendor= Chip Supply
 - Model = 4005-2
 - 3FPGA/B x 8B x 65\$/FPGA
- GLINK transmitter
 - Vendor=?
 - Model=?
 - Instrument 2 spares
 - 3Glink trans/B x 8B x 305/trans
- ECL Level translators
 - Vendor =
 - Model =
 - 12/B x 8B x 3\$/trans
- Connector on VME crate
 - Vendor=?
 - Model=?
 - 3conn/B x 8B x 10\$/B
- Cable from Motherboard to Trigger interface
 - Vendor=3M
 - Model=90101-50
 - 1 cable/B x 16.4ft/cable x 8B x 7\$/ft
- Mating Connector for cable from Motherboard
 - Vendor = 3M
 - Model = 3M82050-6006
 - 1conn/B x 8B x 10\$/conn

4.4 Power Distribution Box

- Lead Engineer = Jan Boissevain
- Vendor=
- One power distribution box separated into four sections, one per motherboard.
- 2 layer board?
- 4 boards + 4 spares= 8 boards total.
- 3.5KNRE + 300\$/B + 1Ksetup + 200\$/Bstuff
- Scanning ADC/Multiplexer
 - Vendor=?
 - Model=?
 - Need to monitor 140 voltages
 - 20 ADC total x 10\$/each
- Polyfuse
 - Vendor=Raytech?
 - Model=?
 - 1 per voltage (140)
 - 140 x 1\$/fuse
- Filter Capacity
 - Vendor=?
 - Model=?
 - 1 per voltage (140)
 - 140 x 1\$/cap
- Arcnet card?
 - Vendor=?
 - Model=?
 - Cost=?
- Cable from Power Connector on Motherboard
 - Vendor= Belden
 - Model= 9159
 - 7cables/Motherboard x 8B x 16.4ft/cable x 2\$/ft
- Connector to attach to DC cable from Motherboard
 - Vendor = Panduit
 - Model =
 - Panduit MAS-CON IDC: 10contact, 8A, (0.156pitch), 18 gauge wire
 - Header (MLSS156-10TA): 31.7mmx3.7mmx3.2mm
 - 7 cables/B x 1conn/cable x 8B x 1\$/conn
- Cable from Silicon Bias on Motherboard
 - Vendor= 3M
 - Model= 90101-50
 - 25mil pitch, shielded (130V Max low current requirement)
 - 2cable/motherboard x 8B x 16.4ft/cable x 7\$/ft
- Mating connector to attach to Silicon bias cable from motherboard
 - Vendor = 3M
 - Model = 3M 82040-6006 and 82050-6006
 - 50 contact connector and 40 contact connector @ 25ml pitch
 - 2H/B x 8B x 10\$/H
 - Cables and Connectors and interlocks from Low and High Voltage Supplies