Lumi Plans to Complete

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Introduction

- We will be presenting each task to complete the project following the WBS prepared
- Additional and separate tasks are shown for beam commissioning support

1 Lumi Project

1.1 Systems Production

1.1.1 Electronics

1.1.2 Gas Systems Upgrades

1.1.3 Detector Upgrades

1.1.4 DAQ System

1.1.5 Documentation

1.2 Hardware Commissioning at CERN

1.3 DAQ Integration with CERN Software

1.4 Physics Studies

1.5 Project Oversight

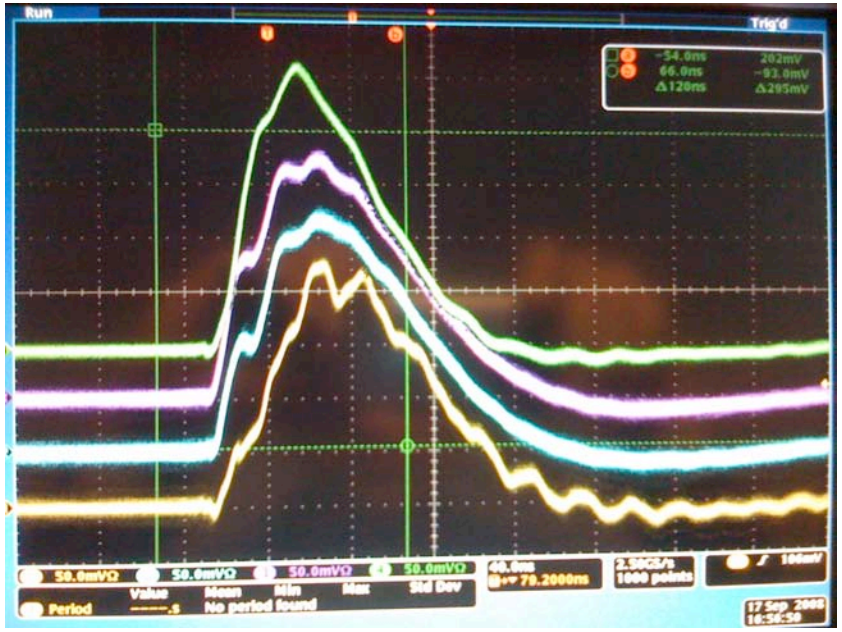
2 Lumi Beam Commissioning

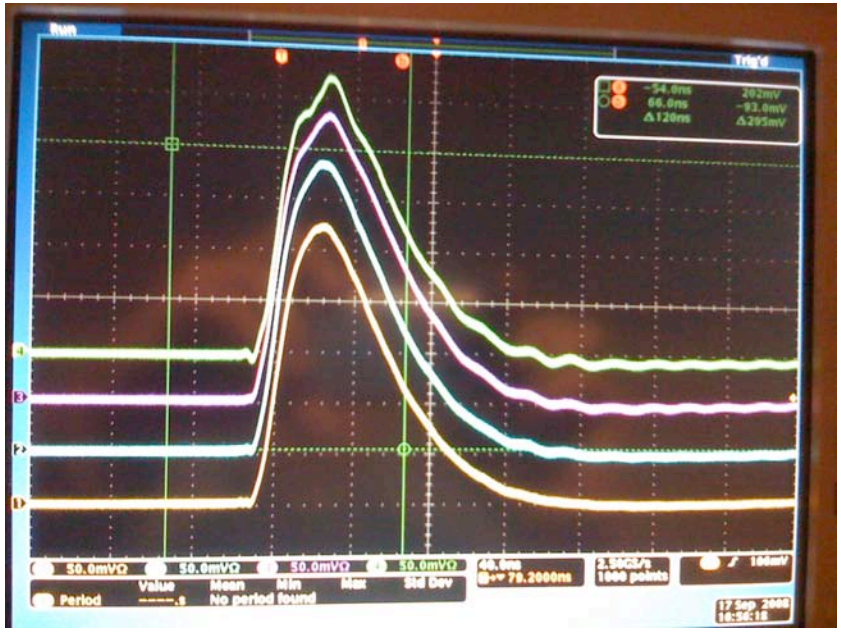
Analog Electronics

- Pre-Amps Production
  - Shield board
  - Signal board
  - HV board
  - Relay board

Detector-PA Integration

- Detector - PreAmp studies
  - Understand interdependencies
  - Optimize configuration



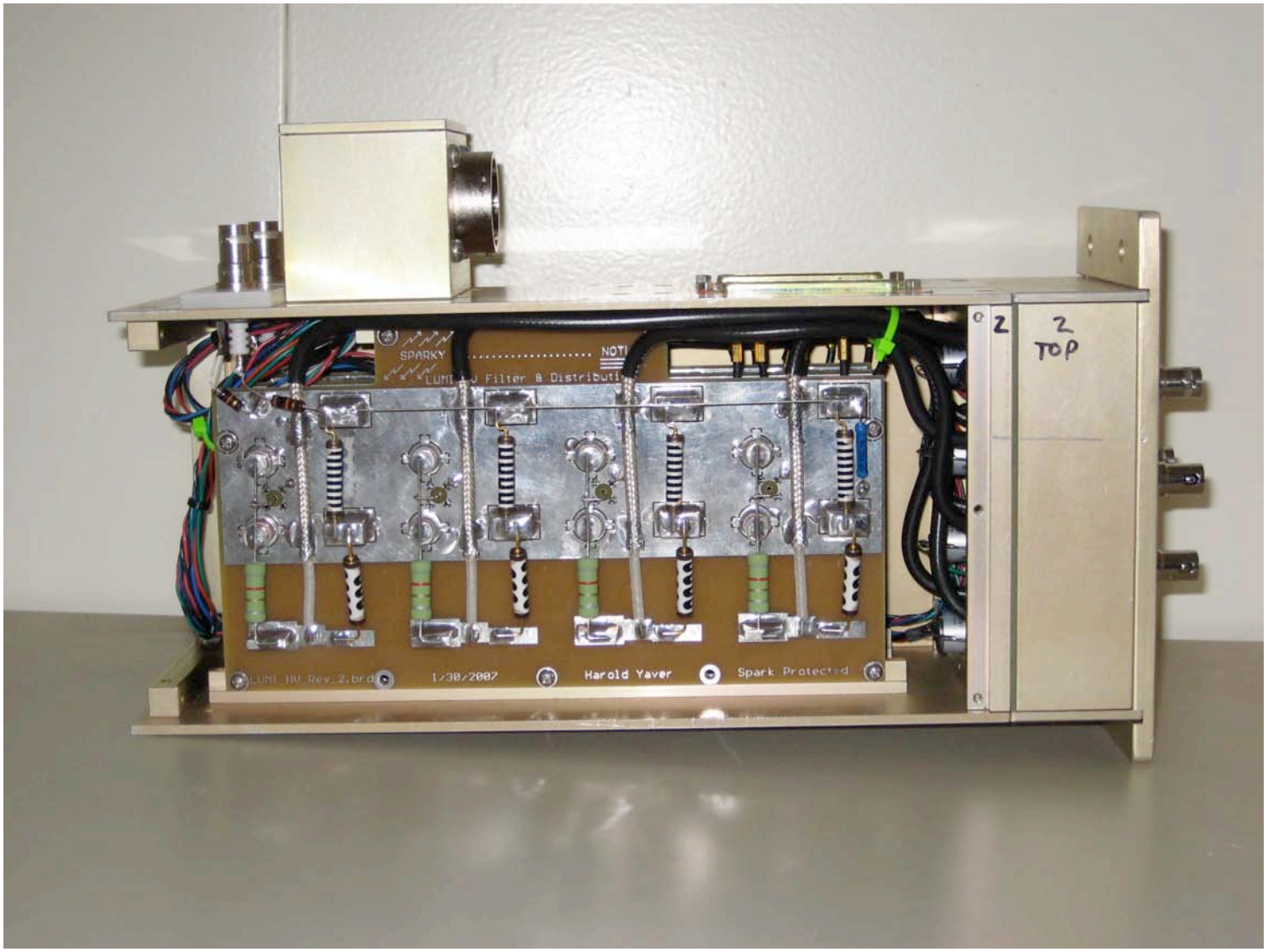


Test pulse - with and without load (detector)

PA Production - HV board

- PA board loaded by vendor
- Load HV Board
  - Parts stress relieved
  - Two cleaning phases
- Mate HV board to PA board
  - HV cables added and terminated to the board
  - Need more cleaning of HV board
  - Minimize heat on HV cables as it deteriorates performance

PA HV Board



PA Production - Shield board

- The shield board is mounted in between the two PA/HV assemblies
- Just a ground plane
  - Carries one RTD and two BJT to monitor radiation damage
- This provides the assembly of the interior of the PA housing
- Coax output cables are added to both PA boards

PA-HV boards

PA Production - HV Relays

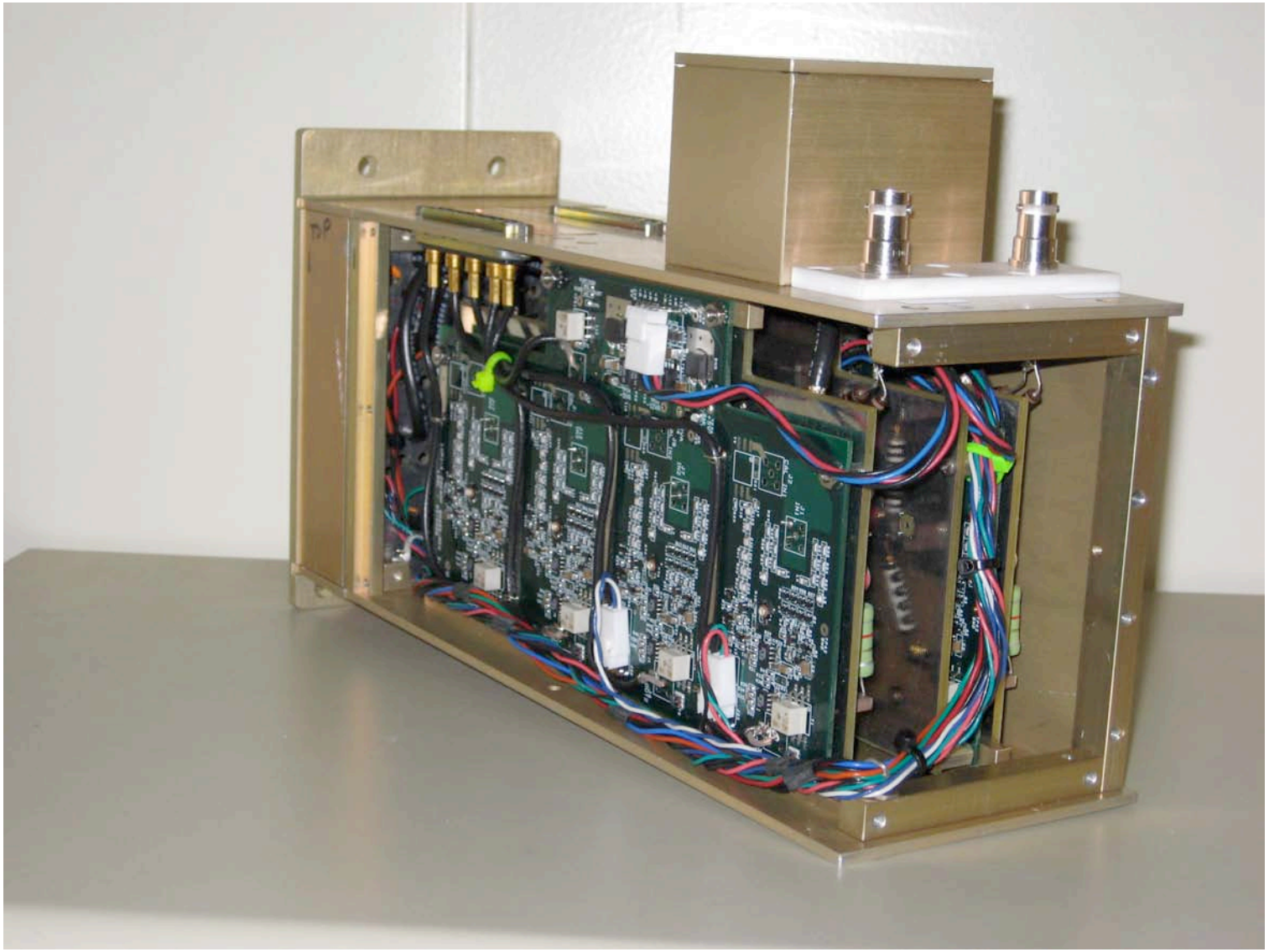
- HV relays are in a single board
  - Switch each channel between either side of the PA boards
  - Individually controlled
- Board is mounted in “input” compartment and separates it from PA/HV assemblies
  - Minimize noise and crosstalk

PA HV Compartment

PA Production - Wiring

- Once all boards are assembled, we can run the RTD wires
  - Pass signal from detector to 28 pin connector
- Run all wires to 28 pin connector
  - 4x2 DC bias supplies, 3x3 RTD signals, 4+2 Relay selector bias, 5 BJT damage

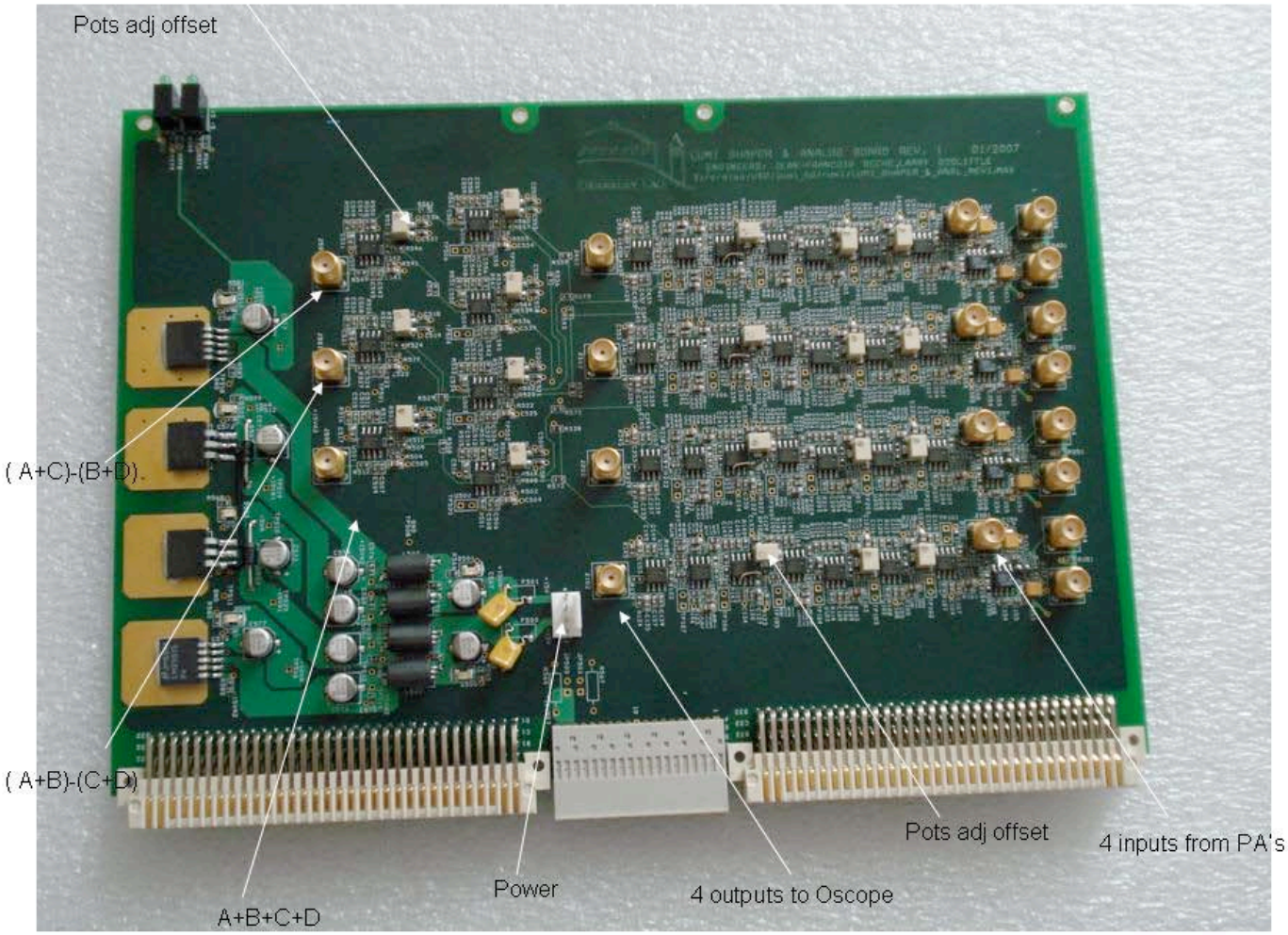
PA Wired to Burndy



Pre-Amp Shaper Integration Studies

- Pre-Amp Shaper studies
  - Optimize => minimize peaking time
  - Package shaper in shielded box
  - Study interaction with PA
  - Study/measure effect of long cable

Electronics - Shapers



Shapers - Plans

- Package in separate chassis
  - Control noise and interference
  - Does not require VME installation
  - Needs independent power supply

- Bench test and integrate with Pre-Amps
- Need 2 per IP, 4 total
  - Will assemble one spare

Electronics - Racks

- Detector Interface Chassis
- Cabling
  - by CERN
- Equipment (procurement)
  - Scopes
  - Linear Power Supplies (from CERN)
    - 1 15V 1.5A Supplies
      - SCEM code: 07.61.24.150.7; CNB: CN5-151.5-CERN-V-CAP
    - 4 ±15V Supplies
      - SCEM code: 07.61.24.160.5; CNB: CN5-D151-CERN-V-CAP
    - 1 5V 2.5A Supply
      - SCEM code: 07.61.24.130.1; CNB: CN5-52.5-CERN-V-CAP
    - Shaper Power supplies - 6V, 0.5A

Detector Interface Chassis

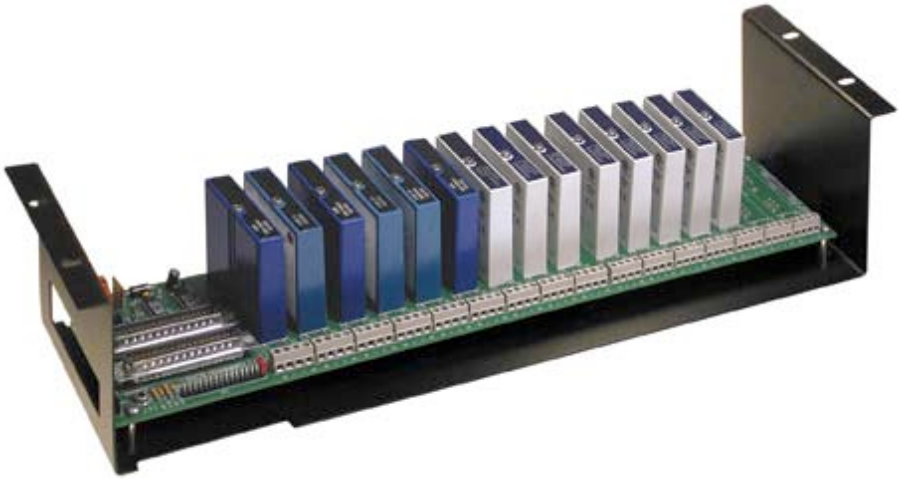
Functions:

- Power 2 Preamps
- Read Preamp/Detector RTDs
  - through Omega DACScan
- Control Preamp Relays
  - through Omega DACScan and front panel
- Measure Preamp Supply voltages and currents
  - through Omega DACScan
- Front panel Test Points for Preamp supply voltages and currents
- Power selector switches in the preamps

Detector Interface Chassis - 2

- Interfaces
  - 2 Preamps
    - 14 twisted pairs - 28 pin Burndy
  - Power from CERN power supplies
  - Omega DACScan
  - Front Panel
    - Meters, lights, switches

Detector Interface - Analog



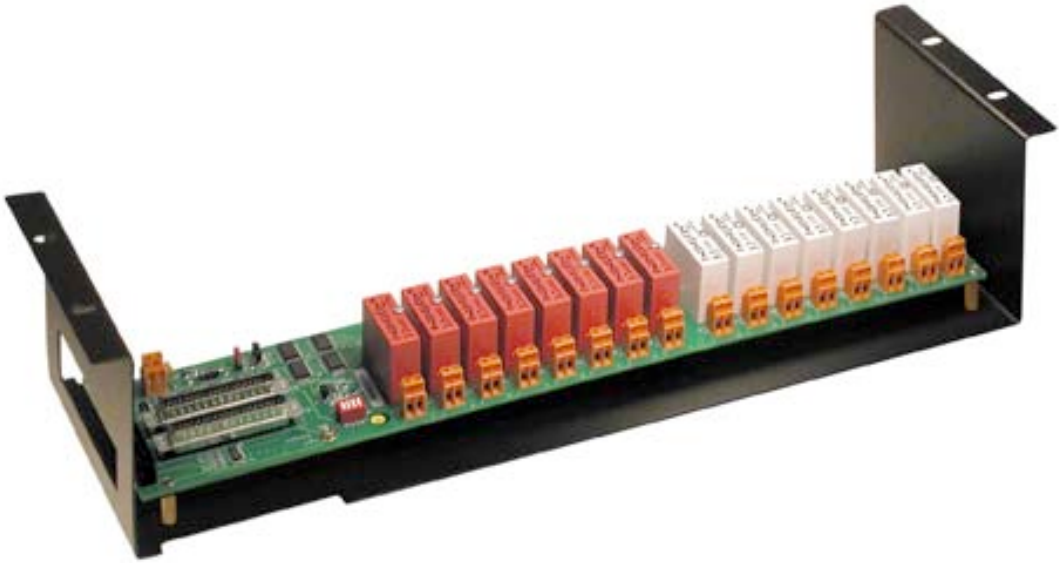
Signal Conditioners:

- OM5-IP-100-C
  - Temperature
- OM5-IV-20A-C
  - Supply Voltage
- OM5-IV-1A-C
  - Supply Current (Voltage across 1 Ohm shunt)

- OMB-DBK207 - Analog Interface

Detector Interface I/O

- DCI5-C
  - Digital Input
- DCO5-C
  - Digital Output



- OMB-DBK208 - Digital Interface

Detector Interface Controller

- Provedes Analog I/O, Digital I/O and Frequency I/O to Ethernet-Based Systems

- All I/O Can Be Synchronous, Enabling Precise Timing Between Various I/O Functions

- 8 Differential or 16 Single-Ended Inputs, Expandable up to 256 Voltage or 896 Thermocouple Channels Using Signal Conditioning and Expansion Options

- Up to 40 Built-In TTL-Level Digital I/O, Expandable Up to 256 Channels of Isolated I/O Using Low-Cost Isolation Modules

- Includes Support for Visual Basic, C/C++, ActiveX/COM, LabVIEW, MATLAB and DAS

OMB-DAQSCAN-2005

Gas Systems

- Systems were built, shipped and installed
- A few action items
  - Add repaired flow meters
  - Continue testing control software
  - Add sensors on hi pressure supply line
  - Perform pressure test by CERN/LHC compressed gases group
- All work must be done on site at CERN
  - Only some software studies at LBL

Detector Testing

- Since LHC beam returns in 2009 we plan to test the (spare) detector @ ALS BTS line
  - Validate new cable configuration on ALS beam
  - Test cable performance on high intensity signals
  - Infrastructure available from previous test
    - 2 axis table, gas lines, signal lines
  - Need to coordinate with analog electronics integration
    - Have only one spare

Detectors

- Modifications required to installed units
  - Add glass tubes
  - Add ceramic tubes
- Must follow assembly procedure almost from the beginning

DAQ System

- All hardware in the racks
  - Provided by CERN
- Firmware programming by LBNL
  - In two phases
- Software
  - Local LabVIEW by LBL
  - FESA class by CERN

DAQ System Testing

- Analog System-DAQ
  - Test full DAQ chain
    - From PA to shaper and DAB64
    - Including long cable

DAQ - Firmware Development

- Phase I - Completed
  - Counting mode
  - Threshold adjustments
  - Stacking
  - BOBR synch (bunch/orbit clock)

DAQ- Firmware Development

- Phase II
  - Pulse height discrimination
  - Deconvolution
  - Crossing angle support
- Will Complete in FY09

- Requires L > 10^32 for beam commissioning
  - 25 ns bunch spacing
  - Nominal bunch intensity
  - Collision multiplicity > 1
  - β squeeze

Software integration

- CERN will provide final software
  - System FESA class driver
  - Expert control panel
- No dedicated panel needed in the CCC
  - Only transfer lumi data through DIP at 1 Hz
- LabView software from LARP to operate the system
  - Will be replaced by final system when ready

Hardware commissioning

- Systems installation at CERN
  - Detector Controller Chassis
  - All rack equipment
  - Cabling checkup and calibration
- Detector installation
  - Electrical lab tests
  - Gas pressure lab tests
- Checkup lists

Detector Installation

- Modifications at IP1L and IP5R
  - Require to remove detectors from tunnel
  - Install ceramic sleeves and glass insulators
  - Repeat pressure, HV tests, RTD test
  - Re-install
- Removal/installation from TAN requires CERN transportation
- Removal from tunnel requires approval from CERN radioprotection

Detector High Voltage Testing

- Once mounted in pressure vessel
- Pressurize to 10 atm absolute
- Connect pre-amp
- Gradually ramp to 2.2kV
- Monitor each channel for leaks
  - Up to 10/min allowed
  - Test Pre-Amp alone first
- Procedure to be repeated after installation

Detector Production Checklist

- Pressure check
- Voltage test
- RTD test
- TDR measurements
- Labels
- QA documents

Detector installation checklist

- Ground connections
  - test single point in tunnel
- Preamp cabling checkout
- Gas pressure/flow test
- After PA connection
  - Test HV performance
  - Test PA with cal signals
  - Test relay selectors

Physics Studies

- MARS/Fluka modeling
  - In support of the ongoing systems development
  - In preparation for LHC beam operations
- SPS and other beam test data analysis
- DAQ programming support
  - Specification and testing

Project Support

- Project management
- Admin and budget support
- Travel
- Shipping

Summary

- Have defines all aspects of the project until its final completion
- WBS follows this outline
- This scope guides cost estimates and contingency analysis
- Beam Commissioning Support not included in project