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Barrel Testing

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1 Introduction

This note summarizes the components needed and the state of readiness for testing ladders in a barrel. The plan is to first construct a fourth barrel which will consist of 2 adjacent, fully-functional, electrical wedges. To have good balancing of the load, a pair of wedges with mechanical ladders will be installed diametrically across from the electrical wedges. The time scale for construction of the fourth barrel is limited by the availability of functional ladders, and that is an unknown at this point. Nevertheless, we are aiming to have a system in place which is capable of testing ladders in the fourth barrel by mid-July 1999.

The primary tasks which need to be addressed for getting a system in place for testing the ladders in a barrel are:

- Infrastructure
- Cooling & Plumbing
- Readout of Barrel
  - Production System
  - Prototype System

Below I discuss each of these and their state of readiness.

2 Infrastructure

The infrastructure for testing ladders refers to the following items.

- Barrel assembly fixture
- Drybox
- Support structures

The production barrel assembly fixture is used to provide precise alignment of the bulkheads, and insertion and alignment of the ladders, while on the CMM machine. The parts for the production barrel assembly fixture are being addressed by Joe Howell at SiDet. Most of the parts are in hand, with the remainder expected to arrive within about a month.

A drybox is being constructed which will provide a dark dry atmosphere in which the ladders will be tested. It has been designed by Greg Derylo and John Mammoser at SiDet, and most of the parts are in hand. They are in the process of constructing the box at Lab C. It is reasonable to assume that it will be done in about a month.

The support structures refer to the components which are used to support and cool the port cards (PC's). Greg Derylo at SiDet has designed a mounting/cooling plate for both the prototype port cards and the production port cards. For the prototype PC's, he has also constructed one. To suspend the mounting/cooling plate, a "tower" has been designed, but has yet to be built. These parts should be in hand within about a month. The support structures for the production PC's should be ready within $\approx$6 weeks.

Once the components have been demonstrated to work well on one CMM, a second set will be constructed for the second CMM.

3 Cooling & Plumbing

The cooling system will need to deliver coolant to 2 bulkheads and 2 PC cooling plates on two CMM machines. In the immediate future, we will only need to supply coolant to the bulkhead and PC plates at one of the CMM stations, but we should have the flexibility of expanding the operation to two CMM machines at some later time. We still need to address whether the chiller will be located inside or outside the Lab C cleanroom. The chiller will keep the bulkheads and PCs at or below 15-20 C and will probably keep the pressure in the bulkheads below atmospheric pressure. Many of the other components in the cooling system will be actual production parts (spares), so we can gain experience using them. A schematic of the cooling system is shown in Fig. 1. The components needed and there status are as follows:

- 2 glued bulkheads + feed tubes - needs to be done in the next few weeks
- Chiller - has been ordered and should be here by 6/11/99
- Filter and Deionizer - in hand
- RTDs for bulkhead - in hand
- Humidity sensor and transmitter - needs to be specified and ordered, I have a possible candidate
- Cooling Control
  - Flow transmitter - in hand
  - Control Valve - in hand
  - Pressure transmitter - in hand
  - ΔP transmitter - in hand
  - Isolation valve (1/4 turn) - FNAL stockroom
  - Vacuum pump for operating sub-atmospheric and drying out bulkhead - in hand
- Cooling fittings to bulkhead - designed, prototypes made, to be tested soon
- Plumbing/routing of cooling lines - not layed out yet

Jow Howell and Brenna Flaugher have been spearheading the effort on preparing the bulkheads for barrel assembly. They will need to be pressure tested as well as have pressure drop versus flow rate measurements made at the Proton Assembly Building (PAB). Some combination of Bruce and I will be responsible for constructing and testing the other components of the system.

4 Readout Components

Apart from the full DAQ system, there are some components which have several versions with which to work. Here I want to briefly introduce the various power supplies, port cards, and junction boards in the context of their role in testing a barrel.

The ladders require both power and control signals to operate. The power needed includes AVDD (+5V), DVDD (+5V), DOIM (+5V), DOIM (+2V), Dterm (2.5 V), and V_{bias}. The specifications for the power supply are described in Ref [1]. Power from the power supplies is passed to a junction card, which merges the power lines with timing signals from the FIB onto a single cable. This cable connects to the port card, thus providing all the voltages and timing signals for operation of the ladders.

4.1 Port Cards

There are three versions of port cards which are used in various systems and teststands. The first is the discrete port card (DPC); the second is the prototype compact port card (prototype CPC), and the last is the production CPC. A description of the functions of the port card can be found in the Ref. [2].

The DPC is a large circuit board with standard board mount connectors. Connections are made using standard flat or ribbon cable. It can only provide power and control signals to a single ladder. This is a very early stage port card, and can only accommodat up to one device (ladder).

The second flavor of port card is the prototype CPC, which is a compact version of the port card and can handle up to 5 ladders. The prototype CPC accepts signals from the Old Junction Card (see below) via a 69-pin Berg CONAN connector (female on CPC, and male on OJC side). Control signals and voltages are passed to the ladders through 5 pairs of Berg CONAN connectors (41-pin and 51-pin). Since the HDI's use ELCO connectors, CONAN-to-ELCO adaptor boards are required.

The production CPC is the port card which we intend to use for the SVXII detector in B0. Among some of the differences with the prototype are that this PC has ELCO connector fields on it to which the HDI's are directly attached. Also, the Cu-Kapton cable which carries the power and control signals (from the junction board) is soldered to this port card. This connector field is different between the prototype and production port cards.

4.2 Junction Cards

The junction board is used to merge the timing/control signals and power lines onto a single cable. Again there are three versions.

The first is what I refer to as the "Old Junction Card" (OJC). It was designed about two years ago, and it is relatively large board ($\approx$7"x7"). The board has a short Cu-Kapton extension ($\approx$4 in.) which can be directly plugged into the prototype CPC. A schematic of the OJC is shown in Fig. 2. The layout of the board can be gotten from Greg Deuerling at FCC. The board has 4 board mount connectors: 3 of them include the power and ground pins for the five ladders; the fourth connector accepts the timing and control signals from the FIB. The power and controls signals are routed onto a short Cu-Kapton cable. **The OJC is only compatible with the prototype CPC (it is not compatible with the production CPC).**

The second junction board, the "test junction card" (TJC) is being designed by UNM, and the specifications can be found in Ref. [3]. It is intended to be mated only with the production CPC. This test version has additional features which allow for load testing of the power supplies and test points for looking at timing/control signals from the FIB. In addition, since DVDD, DOIM voltages, and Dterm are not regulated on the PC, the TJC has sense lines in order to correct for any voltage drops on these traces. As with the OJC, it's purpose is to merge the power and control signals onto a separate single Cu-Kapton cable. This Cu-Kapton cable has two CONAN connectors on either end; one is a 41 pin connector and the other is a 51 pin connector. This Cu-Kapton cable mates with a second Cu-Kapton cable, which is soldered to the production port card. This latter Cu-Kapton cable is called the "pigtail cable", and it's specifications can be found in Ref. [4]

The final version of the junction card, the "production junction card" (PJC) will be very similar to the TJC, except it will be a more compact version without the extra test points or the duplicate sets of connectors for load testing the supplies.

4.3 Power Supplies

In general, we need 6 voltages: +5V AVDD, +5V DVDD, +5V DOIM, +2V DOIM, +2.5V Dterm, HV (sensor bias). There are 3 possibilities for powering the ladders during barrel construction. Either we can use benchtop supplies, the UNM supplies, or the CAEN supplies. Here we briefly discuss each.

The first option, to use benchtop supplies to supply the 6 voltages, is the least attractive, but this is the current means of powering chip cards, ladders, etc. This would require 6 supplies to provide the voltages mentioned above.

A second option would be to utilize the VME based UNM power supplies. The specifications for the UNM supplies can be found in Ref. [1]. These power supplies have been tested in the past by Mark Bailey and Mike Gold. Each PS module provides all the necessary voltages to power a ladder (up to 20 chips) as well as sense lines for remote control of the digital voltages. The sense lines are not necessary to operate the UNM supply, but would provide better control of the digital voltages. The UNM output connector has a single 50-pin connector which has the same pinout as the J3 connector on the OJC (see Table 6). While each UNM supply can handle the power load for up to 20 chips, it's output connector only has lines for a single device. Therefore, in principle we need 1 UNM supply for each ladder. Since we only have 4 supplies, this solution is limited in scope. There is the possibility that we could use a single supply to power several ladders (keeping the total number of chips powered below 20), but this option would need to be explored more thoroughly since in this case the different ladders all share the same power and ground at the power supply (ground loops?). One drawback of the UNM supplies is that changing of the output voltage requires physically changing a resistor on the board [5].

The final power supply solution is to use the VME based CAEN Power Supplies, if they are available. They have a significantly different pinout than the OJC, but do have all the voltages necessary to operate a full wedge. The pinout of the CAEN is intended to have 3 connectors which supply analog voltages, digital voltages, and bias voltages, and a fourth which has the sense wires for remote sensing of the digital voltages. Using the CAEN supplies is the preferred solution, since each power supply can power a full wedge, and it is the supply we will need to understand for the real system. Some adaptors are going to have to be made though to mate the power supply pinouts to the OJC pinouts.

It is important to pint out that the CAEN supplies are tailored to power a wedge. That means that the current limits depend on the layer number, and thus a single CAEN supply cannot power five L2, L3, or L4 ladders. However, because of the contingency in the power supply specifications [1], we should be able to power as many as three L2, L3, or L4 ladders with a single CAEN power supply.

The compatibility of the power supplies, junction cards and port cards is illustrated in Fig. 3. Currently, we operate ladders in configuration #1 in Fig. 3. We use individual power supplies, the old junction card (OJC), and a prototype CPC (or discrete PC, in which case the OJC is not necessary).

5 Readout of Barrel 4

The current plan is to begin construction of Barrel 4 sometime in mid-July to early August. It is not clear whether or not the ladders will be fully debugged by that time. Nevertheless, we are forging ahead on the presumption that ladders will be available.

The decision as to whether to use "prototype" or "production" parts to test Barrel 4 depends on the availability of functional production parts. If all the parts exist, it would be advantageous to use the production system. In the case that not all the production parts are ready, we should be prepared to use the prototype system.

The nomenclature of whether the system is prototype or production stems from whether we use the "prototype" compact port card (CPC) or the production CPC. The choice of CPC has implications for the rest of the components.

In addition to addressing the issues around infrastructure and cooling, we must identify all the components necessary to read out 2 ladders on each end of Barrel 4, and then eventually an entire wedge on either end. Whether we use a prototype or production CPC, the VME modules needed are the same. They include:

1. Fiber Interface Board (FIB)
   - Available pilot board
2. Optical FIB Transition Module (OFTM)
   - One available now, being used for testing CPCs. More available soon
3. Fiber Interface Board Fanout (FFO)
   - ???

4. VME Readout Board (VRB)
   - Should have new one available soon?
5. VRB Transition Module (VTM)
   - Should have new one available soon?
6. VRB Fanout (VFO (prototype version))
   - Two new ones arrived, need to be stuffed
7. Silicon Readout Controller (SRC)
   - "Happy" SRC for DAQ4, needs some repair at Harvard
8. SRC Transition Module (SRCTM)
   - ???

The interconnections between VME modules include:

1. SRC to VFO, copper cable for commands/errors
2. SRCTM to FFO, optical GLINK for commands and clocks
3. SRC to FFO, copper cable, for errors
4. FIB to VRBTM optical GLINK cables for SVXII data

It has been deemed that DAQ4 (CRT1), currently at FCC, will be moved to Lab C, and will become the barrel testing DAQ system. It has been tested at FCC and it is known to be operational.

The rest of the system from the FTM to the port card depends on which port card we use. If we use the production CPC, then we refer to this system as the "Production System". Usage of the prototype CPC implies using a "Prototype System". Depending on which CPC we use has implications for cabling, adaptors, pinouts, etc. These two systems are discussed below.

6 Production System

In addition to the VME modules and interconnects described above, the production system will also include:

1. Test Junction Card (TJC) (UNM) - 7/1/99 [3]
2. Production Compact Port Card (Prototype CPC) - 7/14/99
3. CAEN Power supply (PS) - 6/15/99-7/15/99 [1]

4. Cabling

    (a) PC Flex Pigtail (ESE) [4]- 6/15/99
    (b) TJC Flex Pigtail (ESE) - 7/15/99
    (c) 30 cm HDI Extension Cable (Glasgow) - 6/15/99
    (d) 15 cm HDI Extension Cable (Glasgow) - 6/15/99
    (e) PS Cables (from CAEN to TJC) (specified by UNM)- 6/15/99
    (f) OFTM Signal/Control Cable (ESE) - 6/15/99

The layout of these various components is illustrated in Fig. 4.

6.1 Test Junction Card

The role of the TJC is merge the power/control/timing signals from the OFTM with the power supply voltages, and place them on a single Cu-Kapton cable which is routed to the production CPC. The TJC is the responsibility of UNM. Since the PC Flex Pigtail must be able to plug into the TJC, the design of the connector fields of the TJC were waiting on the completion of the PC Flex Pigtail. Now that it is complete, we expect to have a TJC layout soon, followed by a review of the design. The specifications for the TJC can be found on the web [3]. The pinouts for the power connectors are the same as for the CAEN power supply, and are given in Tables 1- 4. The pinout on the TJC for the control/timing signals are the same as the OFTM (see Table 10). Note however that the OFTM output cable supplies control/timing signals for two TJC's. The digital signals and analog voltages are output onto 41 and 51-point Berg CONAN receptacle connectors respectively, which mate either directly with the PC Flex Pigtail Cable or with the TJC Flex Extension Cable (see below). If we are to use the TJCs, we need one for each CPC. For Barrel 4, this amounts to 4 TJC's. For Barrels 1-3, we would need as many as 16 (4 CPC's per barrel end for two barrels). We would also need an additional one for individual ladder testing on the DAQ prior to putting the ladder in the barrel.

6.2 Production CPC

The critical component which will determine whether we use the production system or not is most likely the availability of tested production CPCs. LBL is responsible for the BeO plates, and we are expecting a few unstuffed CPC's by $\approx$6/10/99. Yuri Gotra will go to LBL to stuff some of them with components, and will bring them back for testing. It is hoped that we will have stuffed and tested production CPC's by 7/14/99. We will have to see how this plays out in the weeks to come. Initially we can manage with just a single production CPC for testing up to 3 ladders. Eventually, to test the four electrical wedges in Barrel 4, we would need four production CPC's. We will also need an additional CPC for testing individual ladders on the DAQ prior to installing them in a barrel.

6.3 CAEN Power Supply

We currently have 1 SVXII prototype CAEN power supply. It is being tested by Claudio Rivetta, and the supply appears to be robust and performing well. With a single CAEN power supply we can power either a full wedge, or up to 3 ladders of any layer. This prototype CAEN supply had the wrong pinout, and so Claudio Rivetta has an adaptor board which translates the pinout to agree with the ones in Tables 1-4. By early July, we are hoping to have 3 pre-production SVXII supplies. If they are received by then, they could potentially be ready to use in Barrel testing a few weeks after. In the beginning, we can get by with testing Barrel 4 with a single CAEN supply, but eventually we would need four CAENs in order to test for effects associated with powering both wedges on both ends of the barrel.

6.4 PC Flex Pigtail

The PC Flex pigtail is a 2 foot long Cu-Kapton flex cable. On one side it is soldered to the CPC. On the other side are a pair of Berg CONAN plug connectors with 41-points and 51-points. The cable is made narrow enough to pass between the DOIMs, while having enough trace width to accommodate 5 L4 ladders each with a voltage drop on this cable of less than 100 mV. The PC flex pigtail has been specified by UNM and ESE [4] and Jim Franzen has produced a layout. We expect to have 20 cables at FNAL by $\approx$6/15/99.

6.5 TJC Flex Pigtail

The TJC Flex Pigtail is essentially an extension cable for the PC Flex Pigtail. It need to be long enough to reach from the Flex Pigtail to the junction cards in the CDF-II detector ($\approx$ 4 feet). The traces on this cable should be made wide enough to limit the voltage drop to less than 100 mV for the power traces. It will have a pair of 41 and 51-point Berg CONAN connectors on each end which mate appropriately to the PC Flex Pigtail on one side and the TJC on the other. The location of the cable is illustrated in Fig. 4. This cable still needs to be designed by ESE, and they think it will have to wait until late July before they have time to work on this cable. This is not a severe problem, because we can plug the PC Flex pigtail directly into the TJC if necessary.

6.6 30 cm and 15 cm HDI Extension Cables

During barrel construction, the port cards will be approximately 50 cm from the end of the ladders. Because the HDI's vary in length with L0 being the longest and L4 being the shortest, we will need an HDI extension cable to reach the port cards. At this time it is not clear what the maximum length of the HDI + HDI-extension can be, but Jean Slaughter has preliminary evidence to suggest that 50 cm will work. We therefore are adopting this as an upper limit on the length. In order for the all the HDI+HDI-extension cables to reach the port cards, we have decided to make HDI extension cables of 2 lengths: one which is 30 cm long and a second which is 15 cm long. The two can be combined to create a 45 cm length HDI extension cable. The plan would be to use the 30 cm extension cable for

L0-L2, and use the combined length for L3 and L4. The extension cables will have a pair of ELCO connectors on either end which have the same footprint as that of the HDI cable. Glasgow is in the process of designing these cables, and we expect them to be ready by 7/1/99.

6.7 PS Cables

The pinouts for the CAEN Power supply are given in Tables 1-4. Each of the 3 connectors contains power or sense lines for five layers. The PS cables have been specified by Mark Bailey [6], and I would propose using those cables to route the voltages from the PS to the TJC. The part numbers are listed below in Section 9. They need to be purchased.

6.8 OFTM Signal/Control Cable

The timing/control cable for the production system sends the timing, control and clocks from the OFTM [7] to the TJC [3]. The TJC is being designed to have the same pinout as the OFTM, and therefore this cable is simply a single, 30 AWG, 0.025" centerline spacing, shielded flat cable (3M #90101/50). One issue is that the OFTM supplies digital signals for two TJC's, and therefore the cable must be split in half, with each half routed to one TJC. The part numbers are listed below in Section 9. They need to be purchased.

7 Prototype System

In the case that the production parts are not ready, we will use the prototype system. The prototype system includes all the same VME modules as listed above, and also includes:

1. Prototype CPC and CONAN-to-ELCO Adaptors
2. Power Supply - Benchtop, CAEN, or UNM Supply?
3. Old Junction card (OJC) - have 4 stuffed cards + 2 unstuffed cards
4. CAEN-OJC Adaptor Board - 7/1/99
5. OFTM-OJC Adaptor Board - 7/1/99
6. Cabling
    (a) Proto Flex-XT Cable - 7/1/99
    (b) 30 cm HDI Extension Cable - 6/15/99
    (c) 15 cm HDI Extension Cable - 6/15/99
    (d) PS Cables (from CAEN to TJC) (specified by UNM)- 6/15/99
    (e) OFTM and OFTM-OJC Signal/Control Cable (ESE) - 6/15/99

A schematic of this readout is shown in Fig. 5, where the usage of the CAEN power supply is assumed. Below we describe the components of the prototype system listed above.

7.1 Port Cards

We should be able to get 2 prototype CPC's for testing barrel 4. Yuri Gotra is in charge of them, and has designated 2 prototype CPCs for usage in Barrel 4 construction.

A feature of the prototype CPCs is that the connectors which connect to the ladder are of the CONAN type, whereas the HDI's have ELCO connectors attached to them. Each prototype CPC requires 10 such adaptors. Twenty ELCO-to-CONAN adaptor boards have been made, of which 10 are at FNAL, and are being used for testing a prototype CPC. We will need to get at least 20 more of these for the 2 prototype CPC's. If these are needed, LBL would need to submit an order for them.

7.2 Power Supplies

I view usage of the CAEN's as perhaps the most aesthetic solution. The reasons being is that it can power a full wedge, and secondly, we gain experience with the supply which we will eventually be using in B0. Let us assume that there is no brick wall which prevents us from using the CAEN with the OJC, and design the system assuming we use CAEN supplies.

The output connectors from the CAEN power supply were not done quite right. Claudio Rivetta has made an Adaptor Board for the CAEN power supply so that the connector pinouts match the specifications of the Test Junction Card. The specifications are that there are 4 connectors. The first connector supplies analog voltages to all 5 layers; the second supplies digital voltages to all 5 layers (including PC voltages); the third connector carries the sensor bias voltages; and the fourth carries the sense lines which sense the digital voltages on the junction card. The pinouts are described in Ref. [3], and are included below (see Tables 1-4) .

We currently have 1 SVX CAEN prototype supply in hand, and we expect to receive 3 more SVX pre-production supplies ≈July 1-15. Production supplies should begin coming sometime in late Sept. 99 - Jan. 2000. While not optimal, we could get by with 1 working CAEN power supply. Usage of multiple CAEN's would be beneficial as soon as the pre-production supplies are tested and certified by Claudio Rivetta.

7.3 Old Junction Card

The Old Junction Card (OJC) was made approximately two years ago. Its purpose is to merge the power from the PS and the control/timing signals from the FTM onto a single cable which connects to the port card. Because the OJC was made nearly two years ago, the pinout does not match that of the CAEN power supply. (This can be contrasted with the Test Junction Card which is currently under construction, and it's pinout and that of the CAEN PS are designed to be the same.) A schematic of the OJC is shown in Fig. 2. The connector J1 on the OJC accepts the control/timing signals from the FTM. The connector J3 accepts L0 voltages and the portcard voltages. The connectors J4 and J5 accept the SVX3 chip voltages for layers 1, 2 and 3, 4 respectively. The signals and voltages from J1, J3-J5 are passed to connector J2 which passes the signals and voltages to the port card. The pinouts of J1-J5 of the OJC are given in Tables 5 -9.

The J2 connection on the OJC is a Cu-Kapton extension which has the pinout shown in Table 9. It may be directly plugged into the prototype CPC which has a mating female 69-pin CONAN connector. During construction of barrel 4, it will be difficult to have the junction card on top of the CMM, and we therefore suggest an extension cable as described below.

There are currently 6 OJC's of which 4 are stuffed. We should have the remaining two stuffed in the next few weeks.

7.4 CAEN-OJC Adaptor Board

The pinouts for J3-J5 of the OJC, shown in Tables 7-9, have a substantially different pinout than the CAENs. Therefore some mating scheme is necessary to route the signals between the CAEN and the OJC. My suggestion is to have an intermediate adaptor board (call it the CAEN-OJC Adaptor board) as depicted in Fig. 5. A conceptual design of this board is shown in Fig. 6. The OJC adaptor board would have 3 (or 4) board-mount connectors which match the CAEN pinouts on one side, and 3 board-mount connectors with the same pinout as J3-J5 of the OJC on the other side. The CAEN-OJC Adaptor board still needs to be constructed. If we are to use 60 feet of 22 AWG cable from the CAEN to the OJC to mimic the real B0 system, there will be $\approx$500-700 mV drop along this cable. To keep the digital voltages close to the nominal values, it would be useful to have sense lines on the adaptor board so that we can regulate the digital voltages. In this case there would be 4 connectors on the PS side, as shown in Fig. 6. Nobody has been assigned to the construction of this board as of yet.

7.5 OFTM-OJC Adaptor Board

Another small adaptor board which needs to be made is the OFTM-OJC Adaptor Board. A conceptual design of this board is shown in Fig. 7. Each OFTM provides control/timing signals for two Port Cards. These signal are put onto a single 50-pin 30 AWG, 0.025" centerline flat cable. To mate with the OJC, the cable must therefore be split in half, and each half routed to individual PC's. In addition, it appears that the signal and $\overline{\text{signal}}$ are reversed between the OFTM and the OJC. Therefore, this card must also reverse the polarity of signal and $\overline{\text{signal}}$. One should pay special attention to the pinout. For example Pin 1 is FE_CLK for the first OJC (CPC) and it's Pin 50 for the second OJC (CPC) [7]. Mary Bishai has a summer student who will be working on this board.

7.6 Proto Flex-XT Cable

This cable is intended to connect the OJC to the prototype CPC. The cable should be a flexible kapton cable with a 69-pin male CONAN connector (Berg #91910-21169) on one side (mates to PC) and a 69-pin female CONAN (Berg #91920-21169) connector (mates to OJC). The pinout in both cases should match that which is described in Table 9. A length of 6 feet should be sufficient for this cable. The traces should be wide enough to limit the voltage drop to less than 100 mV for all digital voltages, since these are not regulated on the CPC. A similar specification, say $\Delta V < 150$ mV, on the analog voltages would be reasonable. This cable has not been made yet, and it is not clear who will design it at this time.

7.7 30 cm and 15 cm HDI Extension Cables

Same as Section 6.6.

7.8 PS Cables

Same as Section 6.7.

7.9 Pinout Definitions

All of the pinouts as I best understand them at this point are in the Tables 1-10. The convention telling which is the first pin and which is the last for various connectors are shown in Fig. 8.

7.10 OFTM and OFTM-OJC Signal/Control cable

The timing/control cables run from the OFTM [7] to the OJC. Each OFTM controls two port cards, so that the timing/control cable feeds two junction cards. The OFTM output connector uses a 50-pin high density output connector (2 rows of 25 pins). It mates to a 50 conductor, 30 AWG, 0.025" centerline flat cable (3M #90101/50). The pinout is shown in Table 10. This cable mates to the OFTM-OJC Adaptor board, and is the same cable which is described in Section 6.8 (apart from the length).

The output of the OFTM-OJC Adaptor board contains two 26-pin connectors which match the pinout of the OJC. A 28 AWG cable (3M #3517/26) routes the signals from the OFTM-OJC Adaptor board to the individual OJC's. This cable is referred to as the OFTM-OJC to OJC signal/control cable. Both ends of ther cable are polarized 26-pin receptacles which mate to the OJC and the OFTM-OJC Adaptor board. See Fig. 7 for more details.

The characteristic impedance of the control/timing signals is 100 Ω. To minimize reflections, we should match this impedance as best we can. The 30 AWG cable has a characteristic impedance of 104 Ω and the 28 AWG cable has a characteristic impedance of 119 Ω. Is this acceptable? In Mark Bailey's office is a 60 foot section of the 30 AWG cable which could be used, although we may want to order more soon. The 28 AWG cable needs to be ordered.

8 Interlock System

The Interlock system will primarily be used to protect the ladders from getting to warm and making sure the relative humidity is in an acceptable range ($\approx< 10\%$). We will use the Interlock system as specified in [8]. The components of the system include:

- TI-575 crate
  - Power Supply
  - 575 CPU
  - VME 162 Master
  - CAEN V288 Controller
  - Network Interface Module (NIM)
  - Reflective Memory Module
- TI-505 crate
  - Power Supply
  - Network Interface Module
  - Remote Base Controller
  - RTD module
  - Analog Input Module
  - Analog Output Module
  - Digital Output Module
- Field devices list under "Cooling & Plumbing" above

We have at least one of all these parts/modules, except the Analog Output Module. Since some of the I/O modules are in the cooling teststand, we will likely leave them there, and use them as spares. Therefore, we will need to order a RTD module, Analog Input, Analog Output, and a Digital Output Module. I will place that order by 6/1/99. A schematic of the Interlock system is shown in Fig. 9.

9 Summary of Parts Needed

DAQ Modules

1. Fiber Interface Board (FIB)
2. Optical FIB Transition Module (OFTM)
3. Fiber Interface Board Fanout (FFO)
4. VME Readout Board (VRB)
5. VRB Transition Module (VTM)
6. VRB Fanout (VFO (prototype version))
7. Silicon Readout Controller (SRC)

8. SRC Transition Module (SRCTM)

VME Cables

1. SRC to VFO, copper cable for commands/errors
2. SRCTM to FFO, optical GLINK for commands and clocks
3. SRC to FFO, copper for errors
4. FIB to VRBTM optical GLINK cables for SVXII data

non-DAQ Modules/Boards

1. Prototype CPC (Prototype System) - Yuri
   - ELCO-to-CONAN connectors - LBL, Yuri
2. Old Junction Card (Prototype System)- Yuri Gotra
3. CAEN Power Supplies (Production & Prototype System) - C. Rivetta, M. Kruse, S. Blusk
4. Interlock System Modules (Production & Prototype System) - Mark Kruse, Steve Blusk
5. CAEN Adaptor Board (Production & Prototype System) - Claudio Rivetta
6. CAEN-OJC Adaptor Board (Prototype System) - ???
   - Input connectors from CAEN PS
     (a) Analog: Positronic Industries #DFDD-26 (26-pin high density receptacle)
     (b) Digital: Positronic Industries #DFDD-44 (44-pin high density receptacle)
     (c) Bias: Amp#1-745967-4 (25-pin vertical PCB mount receptacle)
     (d) Sense: Amp#1-745967-4 (25-pin vertical PCB mount receptacle)
   - Output connectors to OJC, same as ones on OJC (Prototype System)
     (a) On CAEN-OJC Adaptor Board: AMP # 205870-1 (50-pin right angle receptacle) (6 ea.)
     (b) Cable side: AMP # 205212-3 (50-pin crimp-snap plug) (6 ea.)
7. OFTM-OJC Adaptor Board (Prototype System)
   - OFTM side
     (a) AMP #749069-5 (50-pin vertical mount high density receptacle)
   - OJC side

   (a) AMP #102154-6 (26-pin right angle PCB mount header) (6 ea.)

8. DAQ VME Modules - Jean Slaughter, Mary Bishai, Steve Blusk

Cables/Connectors Needed

1. CAEN PS to CAEN Adaptor - Claudio Rivetta

2. CAEN Adaptor to CAEN-OJC Adaptor (Prototype System) or CAEN Adaptor to TJC (Production System)

   - Analog
     (a) Cable: Amphenol #843-11-2214-024 22 AWG Flat cable (24 or 26 cond?)
     (b) Connector 1 (CAEN Side): Positronic Industries #ODD-26 (26-pin high density plug) ;
     (c) Connector 2 (OJC Side): Positronic Industries #ODD-26 (26-pin high density plug) .
   - Digital
     (a) Cable: Amphenol #843-11-2214-038 22 AWG Flat cable (38 cond.)
     (b) Connector 1 (CAEN Side): Positronic Industries #ODD-44 (44-pin high density plug);
     (c) Connector 2 (OJC Side): Positronic Industries #ODD-44 (44-pin high density plug).
   - Bias Voltage
     (a) Cable: 3M #3517/20 28 AWG shielded jacketed flat (20 cond)
     (b) Connector 1 (CAEN Side): 3M #8225-6000 D-sub mass termination connector (25-pin plug)
     (c) Connector 2 (OJC Side): 3M #8225-6000 D-sub mass termination connector (25-pin plug)
   - Sense Lines
     (a) Cable: 3M #1785-20 28 AWG shielded jacketed twisted-pair (20 cond)
     (b) Connector 1 (CAEN Side): 3M #8225-6000 D-sub mass termination connector (25-pin plug)
     (c) Connector 2 (OJC Side): 3M #8225-6000 D-sub mass termination connector (25-pin plug)

3. OFTM Signal/Control Cable (Production System)

   (a) Cable: 3M #90101/50 30 AWG high density 104 Ω flat cable (50 cond.)

   (b) Connector 1 (at OFTM): AMP #786090-5 0.050 Series Cable Connector (50-pin plug) ???

   (c) Connector 2 (at TJC): 3M #10126-6000ec, 10326-1230-00 (26-pin Mini D Ribbon (MDR) plug)

4. OFTM Signal/Control Cable (Prototype System)
   (a) Cable: 3M #90101/50 30 AWG high density 104 Ω flat cable (50 cond.)
   (b) Connector 1 (at OFTM): AMP #786090-5 0.050 Series Cable Connector (50-pin plug) ???
   (c) Connector 2 (at OFTM-OJC Adaptor): AMP #786090-5 0.050 Series Cable Connector (50-pin plug)

5. OFTM-OJC Adaptor to OJC Signal/Control Cable (Prototype System)
   (a) Cable: 3M #3517/26 28 AWG flat 119 Ω flat cable (26 cond.)
   (b) Connector 1 (at OFTM-OJC Adaptor): AMP #746288-6 26 position polarized receptacle
   (c) Connector 2 (at OJC): AMP #746288-6 26 position polarized receptacle

6. Proto Flex-XT Cable (Prototype System) - ???
   (a) Cable: Custom Cu-Kapton
   (b) Connector 1 : Berg CONAN #91910-21169 (69-pin plug)
   (c) Connector 2 : Berg CONAN #91920-21169 (69-pin receptacle)

7. 15 cm and 30 cm HDI Extension Cables (Prototype & Production Systems)
   (a) Cable: Custom Cu-Kapton
   (b) Connector 1 (HDI side): 2 male ELCOs #24 5087 0309 00 861 (Ref. [9])
   (c) Connector 2 (PC side): 2 female ELCOs #14 5087 0309 40 861 (Ref. [9])

References

[1] CDFnote-4705 (specifications apply to CAEN PS as well)

[2] The CDF-II Detector - Technical Design Report November, 1996

[3] http://www-cdf.fnal.gov/upgrades/svxii/power/junction2.html

[4] http://www-cdf.fnal.gov/upgrades/svxii/power/svxii_power.html

[5] Private Communication with Mike Gold at UNM.

[6] http://www-cdf.fnal.gov/upgrades/svxii/power/cable_checklist.html

[7] http://www-ese.fnal.gov/eseproj/svx/svx3_fib/fibspc12.htm (see version dated 3/1/98)

[8] CDFnote-4737

[9] Private Communication with Maurice Scriveres at LBL.

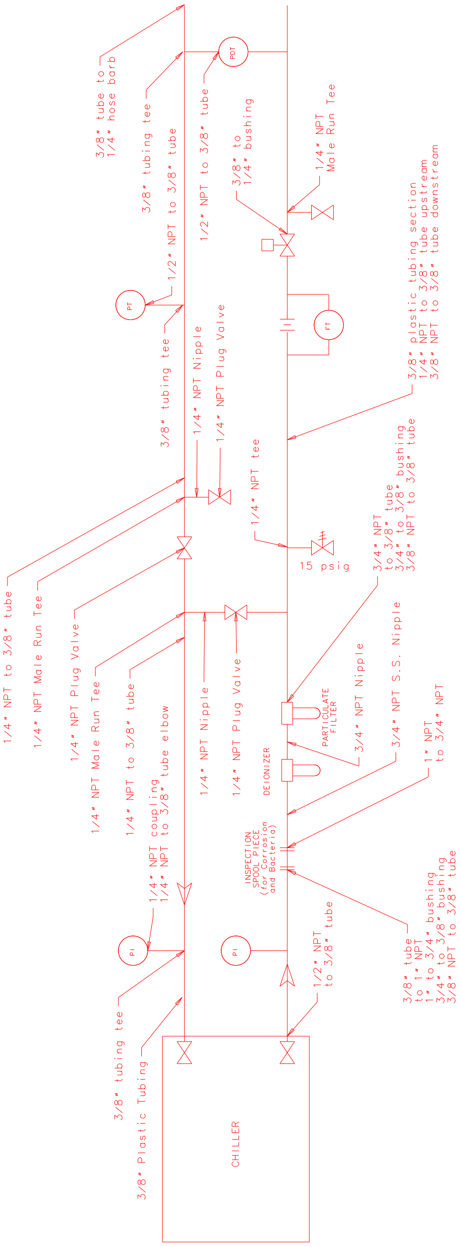

Figure 1: Schematic of the cooling system which will be used for barrel construction in Lab C.

Pin #	Signal Name	Pin #	Signal Name	Pin #	Signal Name
1	UAV_0	10	AG_0	19	UAV_1
2	AG_1	11	UAV_1	20	AG_1
3	UAV_2	12	AG_2	21	UAV_2
4	AG_2	13	UAV_3	22	AG_3
5	UAV_3	14	AG_3	23	UAV_3
6	AG_3	15	UAV_4	24	AG_4
7	UAV_4	16	AG_4	25	UAV_4
8	AG_4	17	UAV_4	26	AG_4
9	Shield	18	Ground		

Table 1: Analog Low Voltage Connector Pinout for CAEN Power Supply. This is the same pinout used for the corresponding connector on the test junction card. The connector is made by Positronic Ind. DFDD-26 -26-pin board mount female connector.

Pin #	Signal Name	Pin #	Signal Name	Pin #	Signal Name
1	DVDD0	16	DGND0	31	DVDD1
2	DGND1	17	DVDD2	32	DGND2
3	DVDD3	18	DGND3	33	DVDD3
4	DGND3	19	DVDD4	34	DGND4
5	DVDD4	20	DGND4	35	+5V_DOIM
6	DGNDP	21	+5V_DOIM	36	DGNDP
7	+5V_DOIM	22	DGNDP	37	+5V_DOIM
8	DGNDP	23	+5V_DOIM	38	DGNDP
9	+5V_DOIM	24	DGNDP	39	+2V_DOIM
10	DGNDP	25	+2V_DOIM	40	DGNDP
11	+2V_DOIM	26	DGNDP	41	+2V_DOIM
12	DGNDP	27	DTERM	42	DGNDP
13	Shield	28	Ground	43	N/C
14	N/C	29	N/C	44	N/C
15	N/C	30	N/C		

Table 2: DIGITAL Low Voltage Connector Pinout for CAEN Power Supply. This is the same pinout used for the corresponding connector on the test junction card. The connector is made by Positronic Ind. DFDD-44 44-pin board mount female connector.

Pin Number	Signal Name	Pin Number	Signal Name
1	DBZ0	14	DBP0
2	DBGND0	15	DBZ1
3	DBP1	16	DBGND1
4	DBZ2	17	DBP2
5	DBGND2	18	DBZ3
6	DBP3	19	DBGND3
7	DBZ4	20	DBP4
8	DBGND5	21	SHIELD
9	SHIELD	22	GROUND
10	GROUND	23	N/C
11,12,13	N/C	24,25	N/C

Table 3: BIAS Voltage Connector Pinout for CAEN Power Supply. This is the same pinout used for the corresponding connector on the test junction card. The connector is made by AMP 1-745967-4 25-pin female connector.

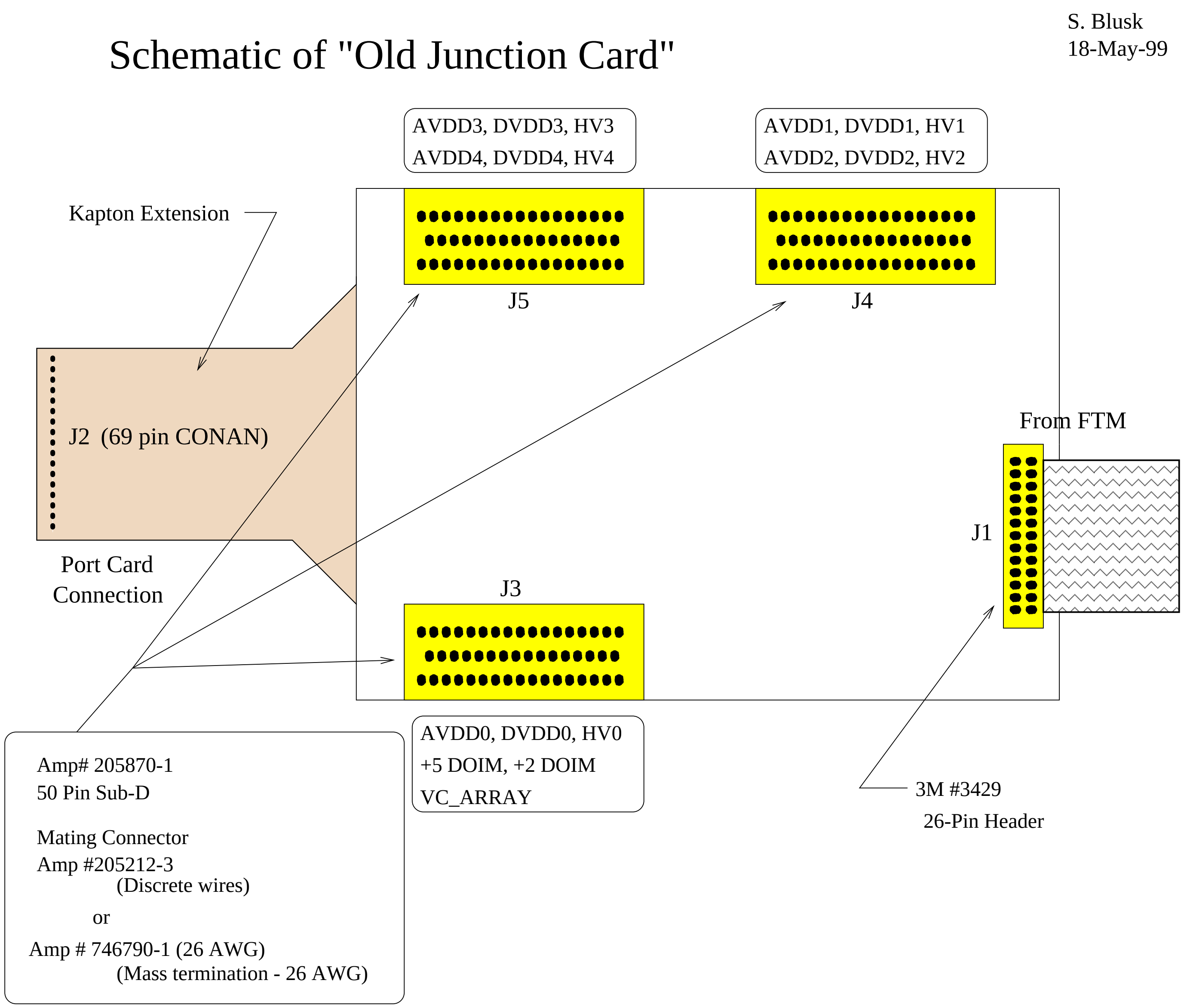

Figure 2: Schematic of the Old Junction Card, showing the connector naming convention. Also indicated are which connectors serve which layers. Connector J1 are the inputs from the FTM. Connector J2 is the outputs which go to the prototype CPC. J3 carries the input voltages for L0 and Port Card voltages. J4 carries the voltages for L1 and L2. J5 carries the input voltages for L3 and L4.

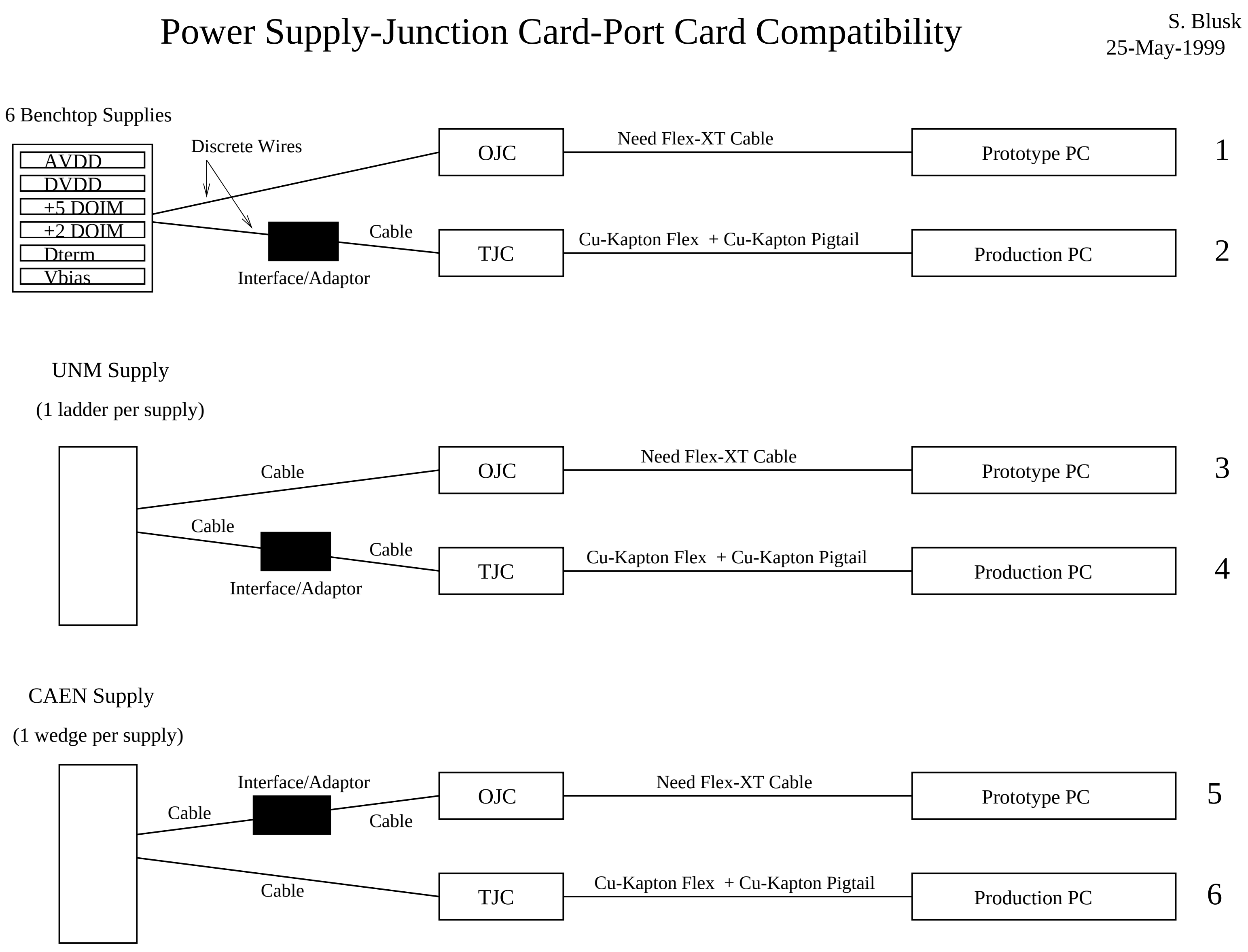

Figure 3: Schematic showing the compatibility of the power supplies, junction cards, and port cards. The indicated adaptors are not the same, and are necessary because of different pinouts between the two modules.

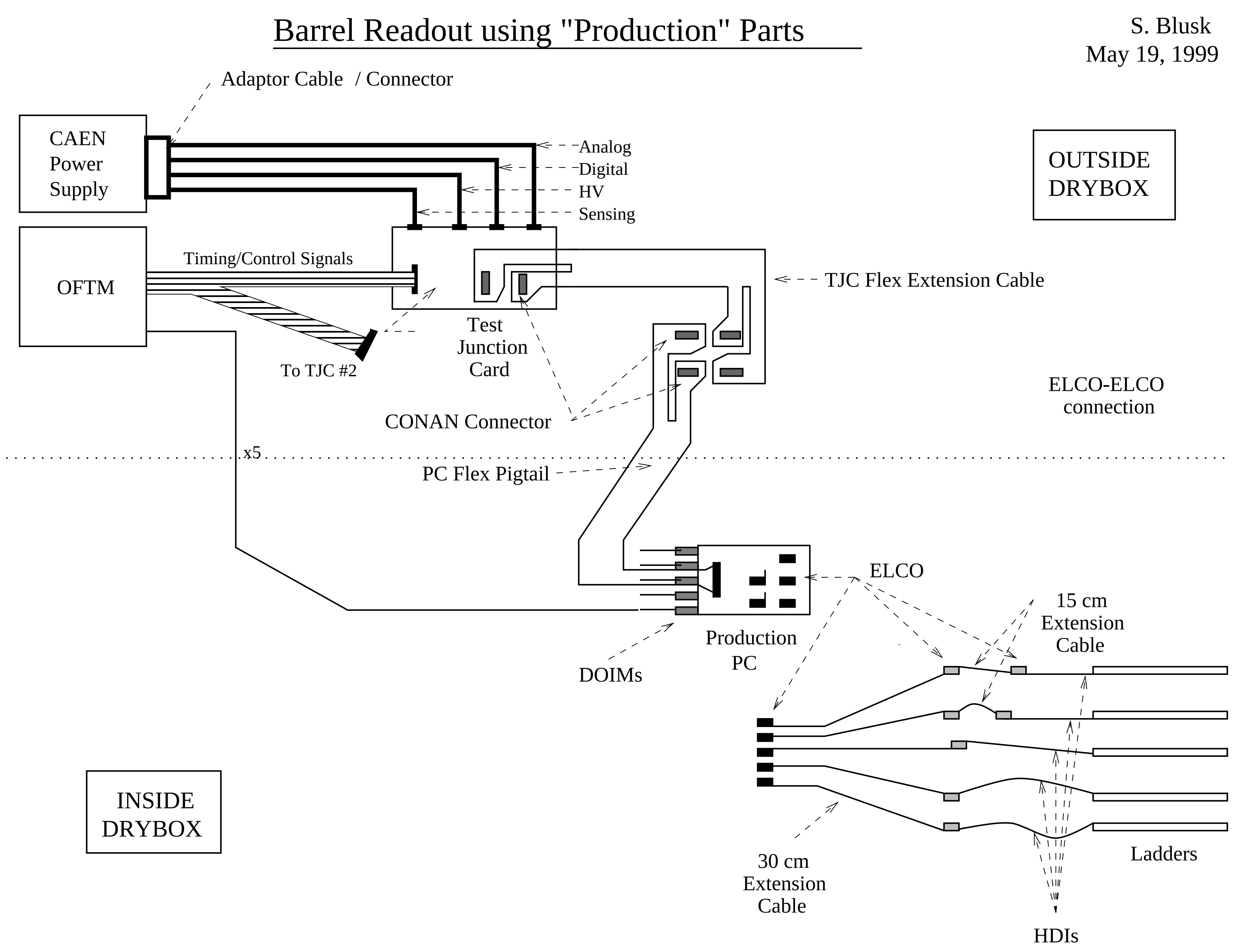

Figure 4: Schematic of barrel testing using production parts. The VME DAQ modules are not shown here.

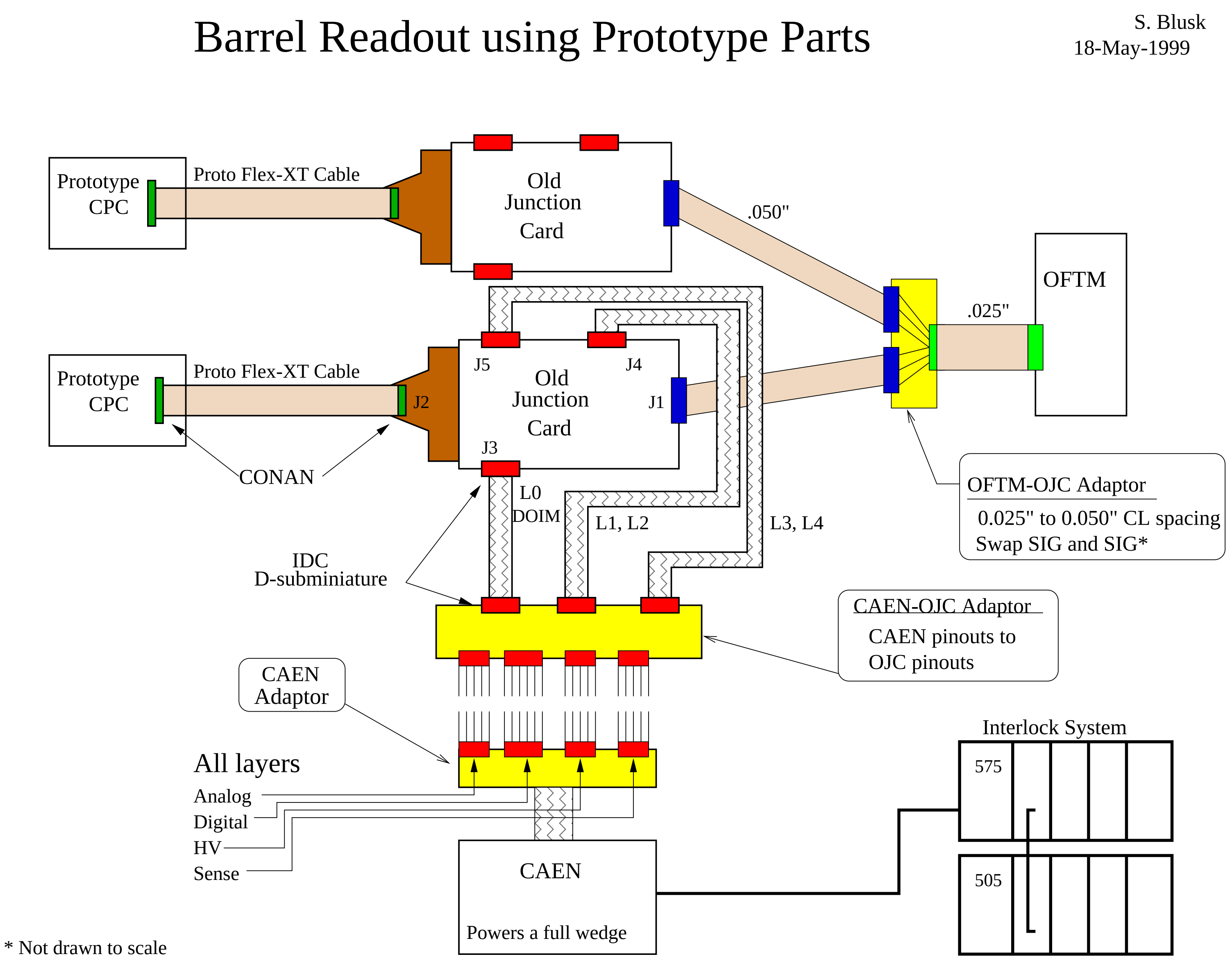

Figure 5: Schematic of barrel testing using prototype parts. the VME DAQ modules are not shown here. Also not shown are the connections to the ladders. Apart from the ELCO-to-CONAN mismatch, it is the same as in the production system.

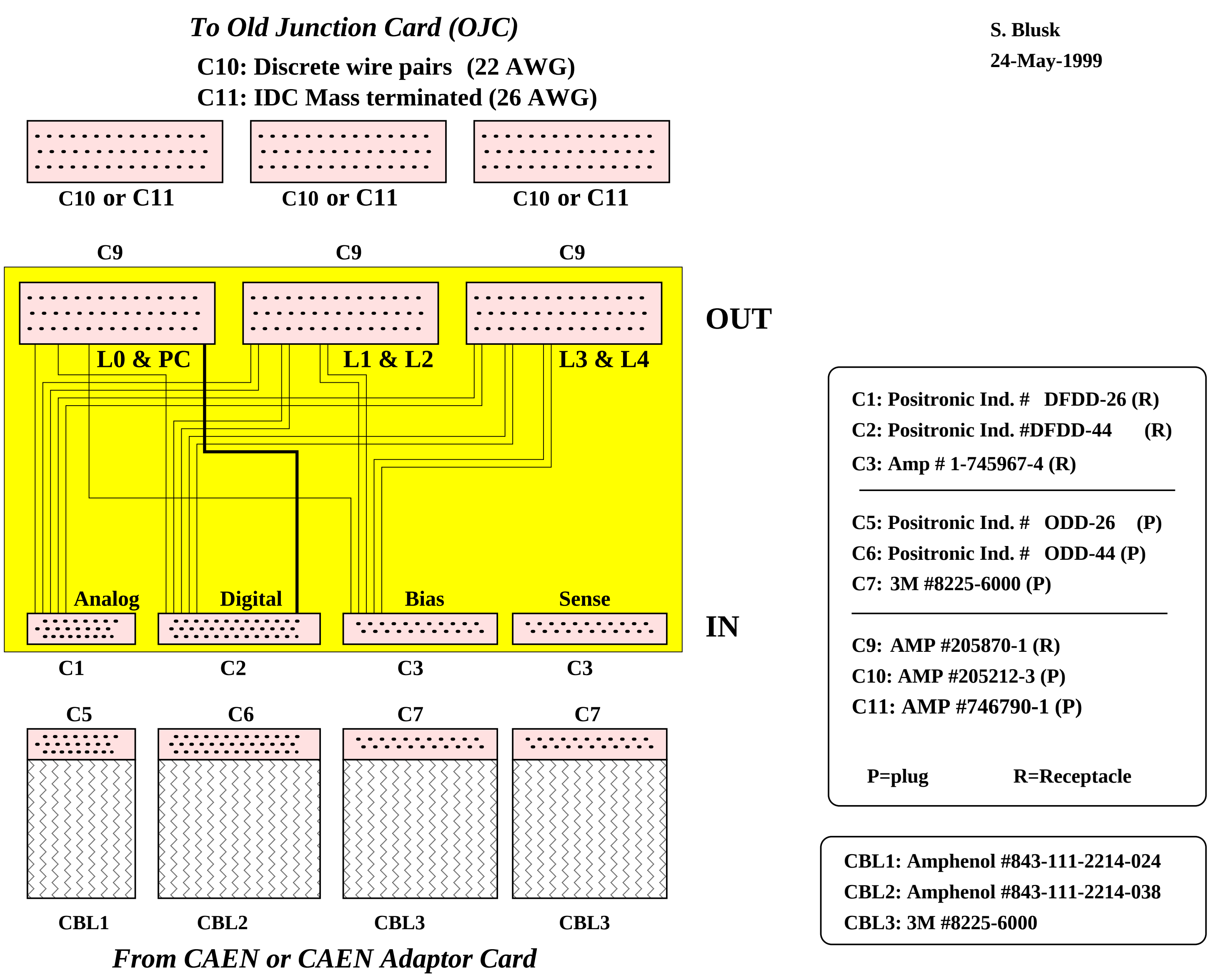

Figure 6: Layout of the CAEN-OJC Adaptor board. The inputs are the voltages from the CAEN, whose connectors have the same footprint as the CAEN connectors. The outputs feed the voltages to the Old Junction Card, and have the same connector arrangement as the OJC. The routing of the signals from IN to OUT is done on this card.

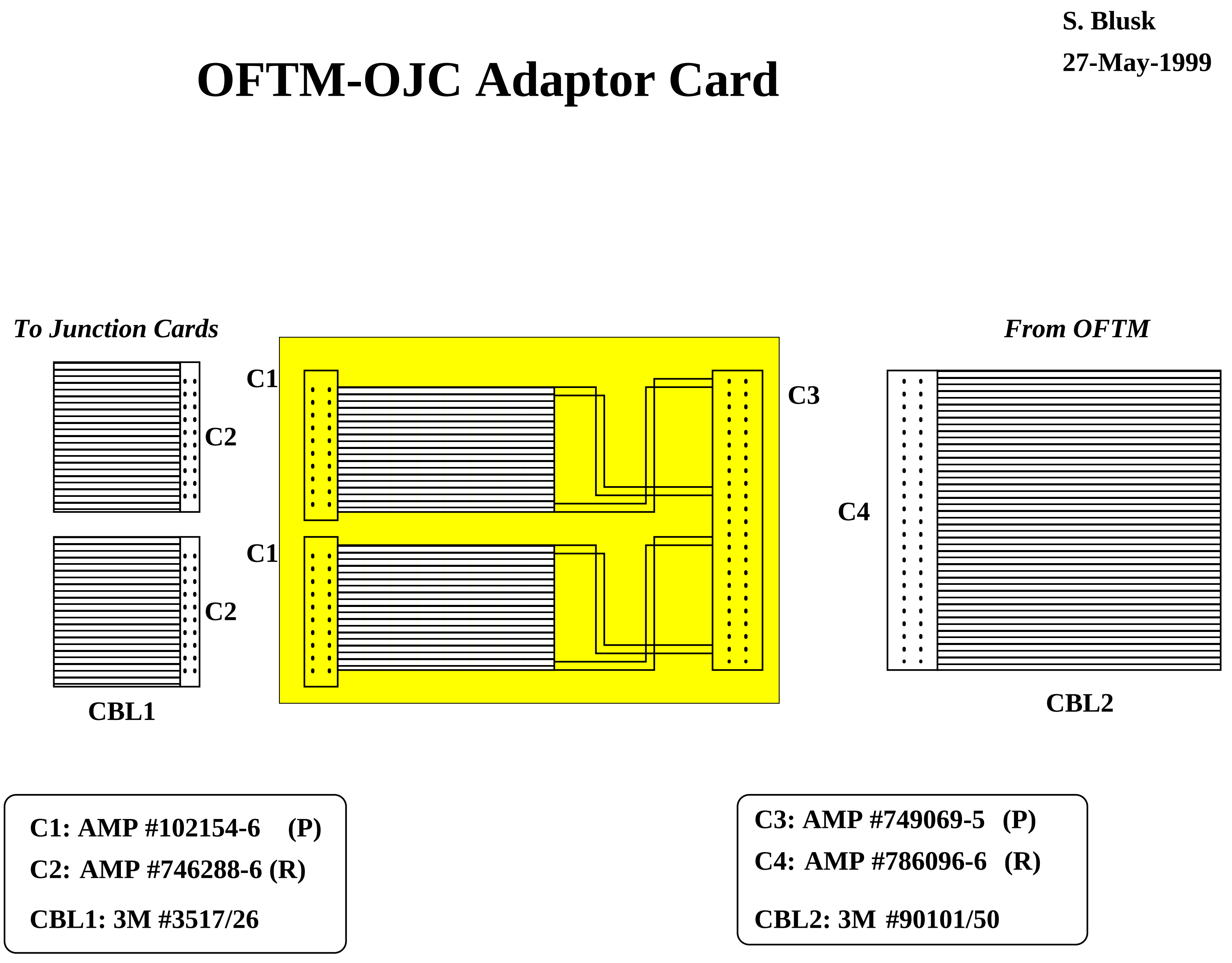

Figure 7: Layout of the CAEN-OJC Adaptor board. The inputs are the voltages from the CAEN, whose connectors have the same footprint as the CAEN connectors. The outputs feed the voltages to the Old Junction Card, and have the same connector arrangement as the OJC. The routing of the signals from IN to OUT is done on this card.

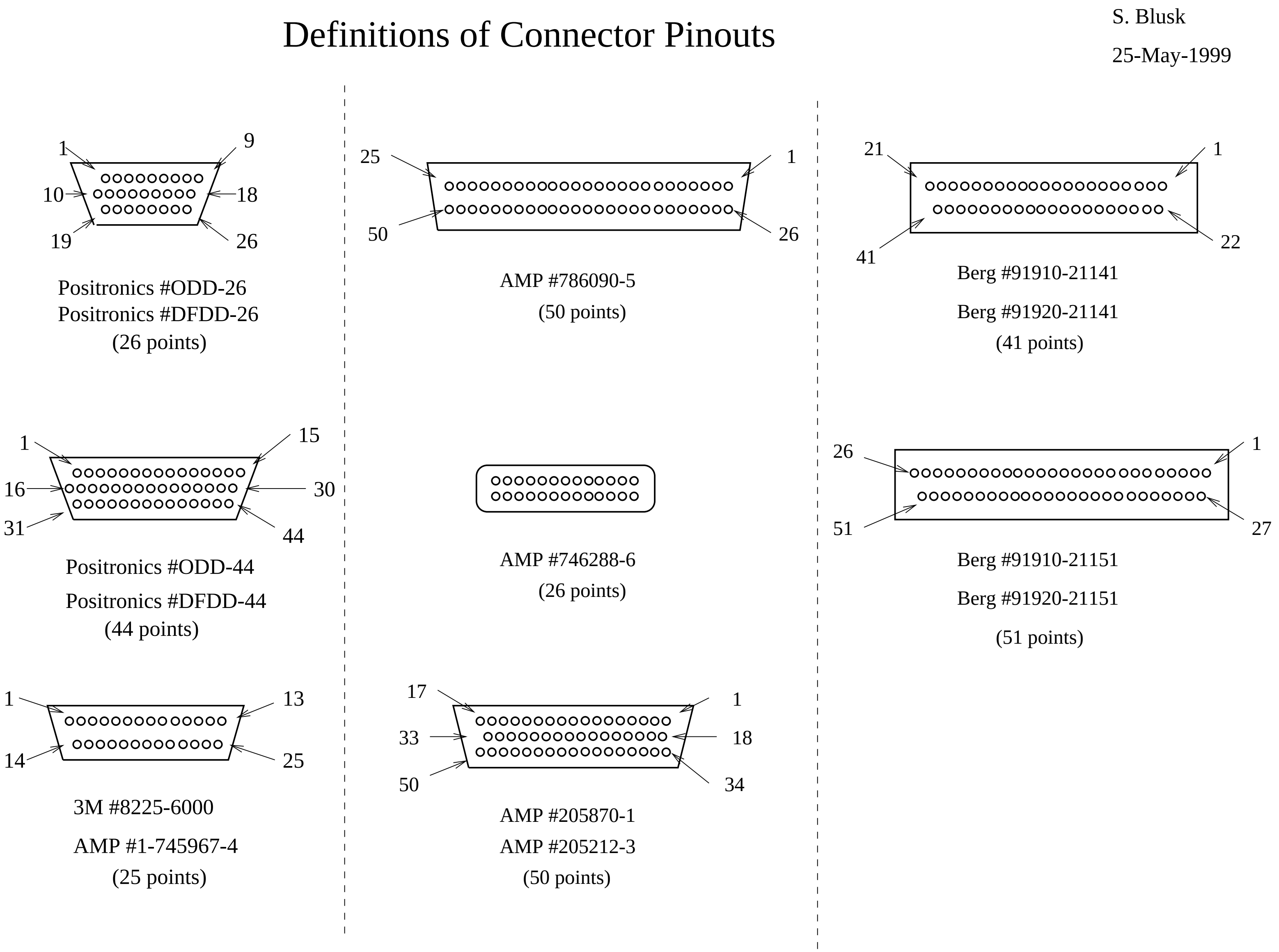

Figure 8: Definitions ofthe pinouts for various connectors which need to be used in the Prototype and Production Barrel Testing systems.

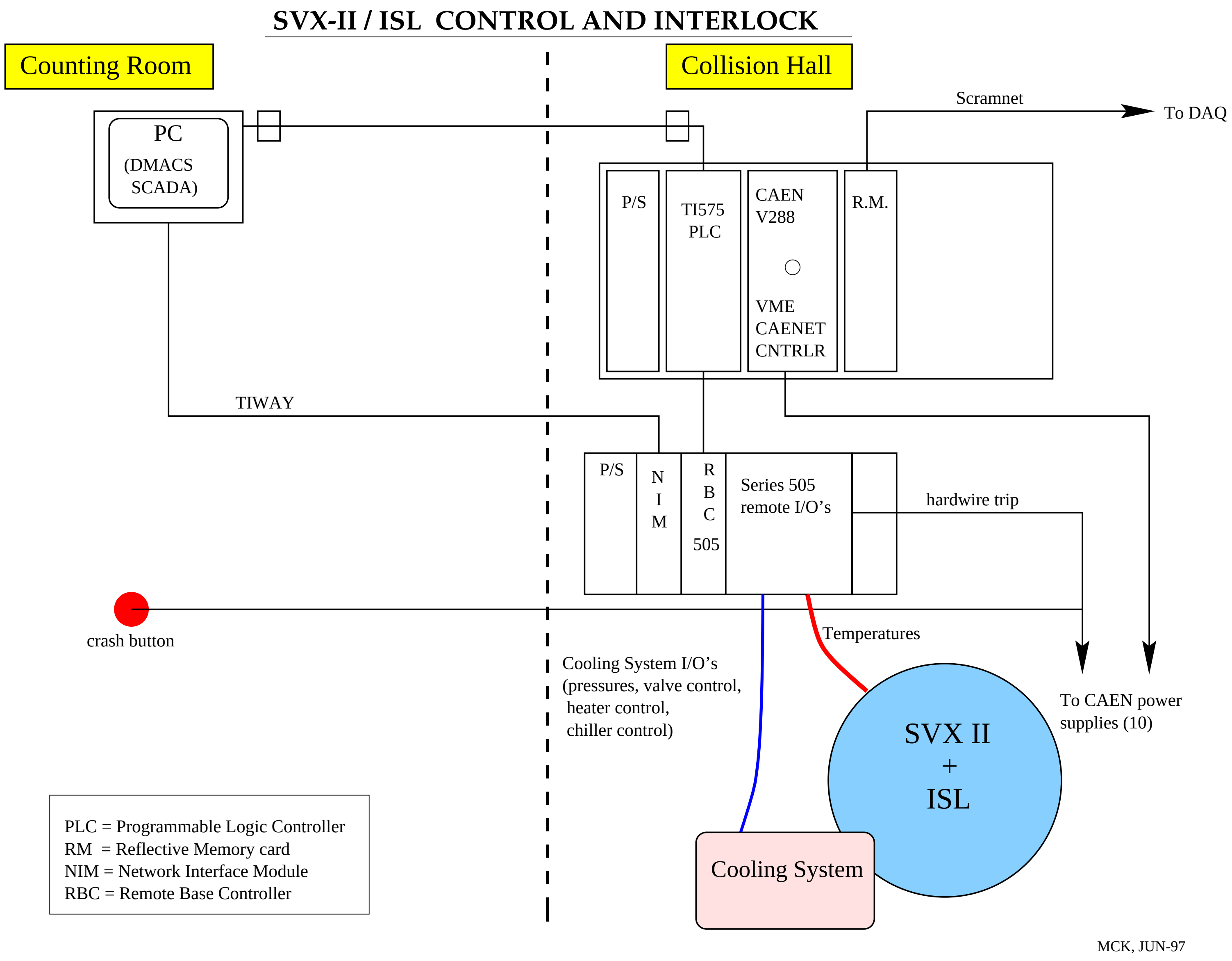

Figure 9: Schematic of the Interlock system to be used for Run II. A similar system will be in place to test barrels during barrel construction.

Pin Number	Signal Name	Pin Number	Signal Name
1	SVDD0	14	SDGND0
2	SVDD1	15	SDGND1
3	SVDD2	16	SDGND2
4	SVDD3	17	SDGND3
5	SVDD4	18	SDGND4
6	S5VDOIM	19	SDGNDP
7	S2VDOIM	20	SDGNDP
8	SDTERM	21	SDGNDP
9	SHIELD	22	SHIELD
10	GROUND	23	GROUND
11,12,13	N/C	24,25	N/C

Table 4: REMOTE SENSING Connector Pinout for CAEN Power Supply. This is the same pinout used for the corresponding connector on the test junction card. The connector is made by AMP 1-745967-4 25-pin female connector.

Pin Number	Signal Name	Pin Number	Signal Name
1	FE_CLK*	14	FE_CLK
2	CLK*	15	CLK
3	C_DATA*	16	C_DATA
4	C0*	17	C0
5	C1*	18	C1
6	C2*	19	C2
7	C3*	20	C3
8	C4*	21	C4
9	BE_CLK*	22	BE_CLK
10	L1A*	23	L1A
11	PIPE_RD2*	24	PIPE_RD2
12	NC1*	25	NC2
13	GND1	26	GND2

Table 5: J1 Connector Pinout for Old Junction Card. This connector accepts the control/timing signals from the FTM and routes them to the Port Card connector J2. 3M Part#3429

Pin #	Signal Name	Pin #	Signal Name	Pin #	Signal Name
1	N/C	18	N/C	34	to pin 50
2	DBZ0	19	N/C	35	?
3	DBP0	20	N/C	36	N/C
4	N/C	21	N/C	37	N/C
5	N/C	22	GND	38	N/C
6	DVDD0	23	GND	39	N/C
7	DVDD0	24	AG_0	40	to J6 (GND)
8	UAV_0	25	AG_0	41	to J6 (GND)
9	UAV2_0	26	GND	42	to J6 (GND)
10	VC0402	27	GND	43	N/C
11	+2V DOIM	28	GND	44	N/C
12	+2V DOIM	29	GND	45	N/C
13	+2V DOIM	30	GND	46	N/C
14	DTERM	31	GND	47	N/C
15	+5V DOIM	32	GND	48	N/C
16	+5V DOIM	33	GND	49	N/C
17	+5V DOIM	-	-	50	to pin 34

Table 6: J3 Connector Pinout for Old Junction Card. This connector accepts the Layer 0 SVX3 chip voltages and Port Card voltages. It is a 50-pin board mount connector (17, 16, 17 pin rows). AMP Part#s 205870-1 and 205212-3.

Pin #	Signal Name	Pin #	Signal Name	Pin #	Signal Name
1	N/C	18	N/C	34	to pin 50
2	DBZ1	19	N/C	35	?
3	DBP1	20	N/C	36	N/C
4	DBZ2	21	N/C	37	N/C
5	DBP2	22	GND	38	N/C
6	DVDD1	23	GND	39	N/C
7	DVDD1	24	GND	40	to J7 (GND)
8	DVDD1	25	AG_1	41	to J7 (GND)
9	UAV_1	26	AG_1	42	to J7 (GND)
10	UAV_1	27	AG_1	43	N/C
11	UAV2_1	28	GND	44	N/C
12	DVDD2	29	GND	45	N/C
13	DVDD2	30	GND	46	N/C
14	DVDD2	31	AG_2	47	N/C
15	UAV_2	32	AG_2	48	N/C
16	UAV_2	33	AG_2	49	N/C
17	UAV2_2	-	-	50	to pin 34

Table 7: J4 Connector Pinout for Old Junction Card. This connector accepts the Layer 1 and Layer 2 SVX3 chip voltages. It is a 50-pin board mount connector (17, 16, 17 pin rows). AMP Part#s 205870-1 and 205212-3.

Pin #	Signal Name	Pin #	Signal Name	Pin #	Signal Name
1	N/C	18	N/C	34	to pin 50
2	DBZ3	19	N/C	35	?
3	DBP3	20	N/C	36	N/C
4	DBZ4	21	N/C	37	N/C
5	DBP4	22	GND	38	N/C
6	DVDD3	23	GND	39	N/C
7	DVDD3	24	GND	40	to J8 (GND)
8	DVDD3	25	AG_3	41	to J8 (GND)
9	UAV_3	26	AG_3	42	to J8 (GND)
10	UAV_3	27	AG_3	43	N/C
11	UAV2_3	28	GND	44	N/C
12	DVDD4	29	GND	45	N/C
13	DVDD4	30	GND	46	N/C
14	DVDD4	31	AG_4	47	N/C
15	UAV_4	32	AG_4	48	N/C
16	UAV_4	33	AG_4	49	N/C
17	UAV2_4	-	-	50	to pin 34

Table 8: J5 Connector Pinout for Old Junction Card. This connector accepts the Layer 3 and Layer 4 SVX3 chip voltages. It is a 50-pin board mount connector (17, 16, 17 pin rows). AMP Part#s 205870-1 and 205212-3.

Pin #	Signal Name	Pin #	Signal Name
1	CFE_CLK	36	CFE_CLK*
2	C_CLK	37	C_CLK*
3	C_DATA	38	C_DATA
4	C_C0	39	C_C0
5	C_C1	40	C_C1
6	C_C2	41	C_C2
7	C_C3	42	C_C3
8	C_C4	43	C_C4
9	CBE_CLK	44	CBE_CLK
10	C_L1A	45	C_L1A
11	CPIPE_RD2	46	CPIPE_RD2
12	+5V DOIM	47	DGNDP
13	+5V DOIM	48	DGNDP
14	UAV_0	49	AG_0
15	DVDD_0	50	UAV2_0
16	DBZ0	51	DBP0
17	UAV_1	52	AG_1
18	DVDD_1	53	UAV2_1
19	DBZ1	54	DBP1
20	UAV_2	55	AG_2
21	DVDD_2	56	UAV2_2
22	DBZ2	57	DBP2
23	UAV_3	58	AG_3
24	DVDD_3	59	UAV2_3
25	DBZ3	60	DBP3
26	UAV_4	61	AG_4
27	DVDD_4	62	UAV2_4
28	DBZ4	63	DBP4
29	GND	64	VC0402
30	GND	65	GND
31	GND	66	GND
32	GND	67	+2V DOIM
33	VREF0	68	VREF1
34	VREF2	69	Dterm
35	VREF3		

Table 9: J2 Connector Pinout for Old Junction Card. This connector merges the timing/control signals from J1 with the power from J3, J4, and J5 and puts them onto this connector which is a 69-pin male CONAN type connector. Berg Part#91920-21169

Signal	PC 1 Pin#	PC 2 Pin#	Signal	PC 1 Pin#	PC 2 Pin#
FE_CLK	1	50	FE_CLK*	26	25
C_CLK	2	49	C_CLK*	27	24
C_DATA	3	48	C_DATA*	28	23
C_C0	4	47	C_C0*	29	22
C_C1	5	46	C_C1*	30	21
C_C2	6	45	C_C2*	31	20
C_C3	7	44	C_C3*	32	19
C_C4	8	43	C_C4*	33	18
BE_CLK	9	42	BE_CLK*	34	17
L1A	10	41	L1A*	35	16
CPIPE_RD2	11	40	CPIPE_RD2*	36	15
C5	12	39	C5*	37	14
Spare - Grd. Ref	13	38			

Table 10: Connector Pinout for OFTM. These are the signals which go to the J1 connector on the OJC. **Note that the polarity is opposite to that which is defined on connector J1 for the OJC.**