

Operational Readiness Clearance (Non-beam operation)

LAr HV & Electronics for TPC Test Cryostat 'Bo'

11 July 2011

AUTHORIZATION TO PROCEED WITH THE UNATTENDED OPERATION OF HV & DAQ FOR 'Bo'

**REVIEWED AND APPROVED BY:**

**DATE**

  
Particle Physics Division Head  
Comments/Exceptions:

7/25/2011

 13747N  
Particle Physics Senior Safety Officer  
Comments/Exceptions:

25 July 11

Leo Bellantoni  
Committee Chair  
Comments/Exceptions: Review conducted by E. McHugh – His approval (attached) is electronic.

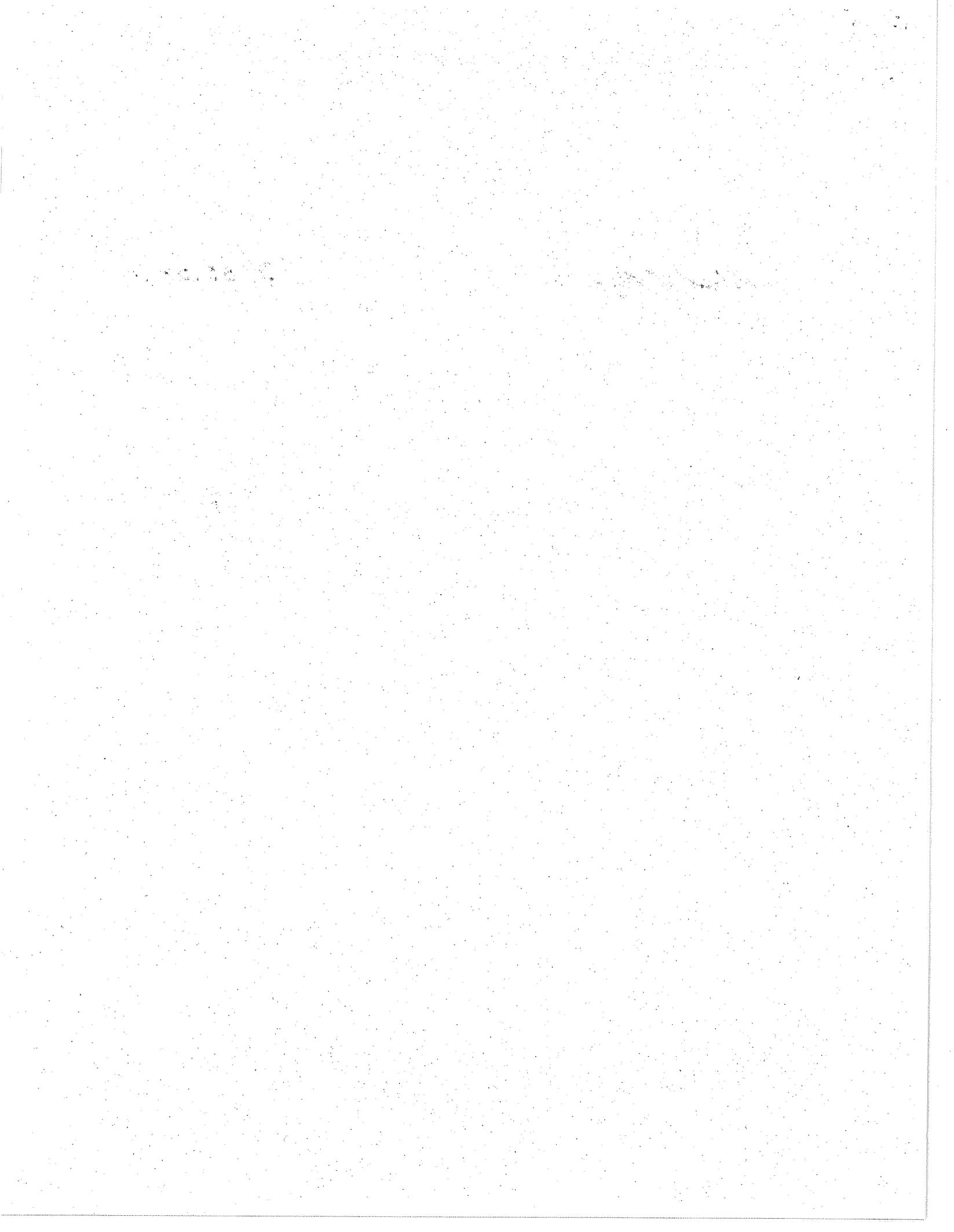
11 July 2011

**Submitted By:**

Stephen Pordes.  
Requester S.Pordes

21 July 2011

Electronic approvals for this form are acceptable. Please forward your responses to all recipients. A signed paper form (copy) of this document will exist in the Particle Physics Division Office. The original signed document will stay with the experiment requesting clearance.



From: Eric D McHugh <emchugh@fnal.gov>  
Date: July 8, 2011 4:02:28 PM CDT  
To: Leo Bellantoni <bellanto@fnal.gov>  
Subject: **Fwd: LArPD HV filter at PAB**

Hello Leo so here is the final piece of the recommendation, but I am on my way to LA at O'hare. I won't be back until Tuesday, would you want me to wait until then to issue the ORC, or would you be able to put that together? Thanks  
Eric

Begin forwarded message:

From: Keith Schuh <schuh@fnal.gov>  
Date: July 8, 2011 3:12:04 PM CDT  
To: Eric D McHugh <emchugh@fnal.gov>  
Subject: **Re: RE: LArPD HV filter at PAB**

I'm OK with Steve's review.

----- Original Message -----

From: Eric D McHugh <emchugh@fnal.gov>  
Date: Friday, July 8, 2011 12:29 pm  
Subject: RE: LArPD HV filter at PAB  
To: 'Hans Jostlein' <jostlein@fnal.gov>, Steve Chappa <chappa@fnal.gov>  
Cc: Leo Bellantoni <bellanto@fnal.gov>, "Pordes, Stephen" <stephen@fnal.gov>, 'Keith Schuh' <schuh@fnal.gov>, "Jaskierny, Walter" <waltj@fnal.gov>

Thank you Steve. Hopefully Keith will be able to comment today, or comment by Monday for the final recommendation.

----- Original Message -----

From: Steve Chappa <chappa@fnal.gov>  
Date: Friday, July 8, 2011 12:23 pm  
Subject: LArPD HV filter at PAB  
To: 'Eric D McHugh' <emchugh@fnal.gov>, 'bellanto' <bellanto@fnal.gov>  
Cc: "Pordes, Stephen" <stephen@fnal.gov>, 'Keith Schuh' <schuh@fnal.gov>, "Jaskierny, Walter" <waltj@fnal.gov>, "Jostlein, Hans" <jostlein@fnal.gov>

Hi All,

I met Eric and Walter out at PAB to look at the changes made to the HV "kettle pot" filter.

- 1) I am satisfied that the pot grounding is now sufficient. The bonding clamps are fixed and as described in Hans' email. Verified that the braid is connected directly to the grounding lug (after a re-examination and re-bolting the braid) on the HV power supply chassis and then the ground connection is carried to the rack and building ground.
- 2) The plate on the right side (looking at the rear door) is bolted to the rack and high enough to keep stuff out of the rack. -OK.
- 3) Verified that the rear door interlock switch is indeed connected. This switch is connected to the supply's inhibit connection on the rear panel terminal switch. -OK.

4) Re-examined the cable feed-through kludged connectors. These feed-throughs are the weak link for this installation. However, the cable used is of an old cable type and after discussing getting an actual feed-through connector, Walter and I are of the opinion that obtaining a manufactured HV connector made for this cable would be rather difficult to obtain. The feed-through shield connection is done by using a copper pipe that is soldered to the screw base. The copper pipe is of sufficient diameter so as not to score or damage the cable's dielectric. The cable's braid shield is spread out over the copper pipe and is not cut or is not partial in contact to the pipe. This cable shield connection seems to be satisfactory. We did need to re-tape and re-clamp the shield on one feed-through since the original tape was not over all of the cable shield and the clamp was placed directly over the braid shield. Plus, the clamp had to be replaced since the original one used was stripped and did not provide sufficient clamping pressure for the braid connection.

After this repair, and the added protection using the rear door interlock, this should provide sufficient personnel protection in the event of a HV fault. Plus, the cable is confined to inside the rack and thus not subject to connection/reconnection or movement. Thus the chances of cable damage when the HV is on is minimal. However, the use of this filter in an ORC installation should be limited to this present use at PAB (for R&D). If moved to a more permanent installation for unattended operation, then cable with the proper feed-through connectors should be acquired and used.

Therefore, after reviewing the changes made to the HV filter for the installation at PAB, I am recommending it for the issuance of the ORC.

Regards,  
Steve

From: Steve Chappa <chappa@fnal.gov>  
Subject: RE: Bo Cold DAQ review findings  
Date: June 16, 2011 12:37:41 PM CDT  
To: 'Dan Edmunds' <edmunds@pa.msu.edu>, Leo Bellantoni <bellanto@fnal.gov>  
Cc: Eric D McHugh <emchugh@fnal.gov>, 'Keith Schuh' <schuh@fnal.gov>, 'Walter Jaskierny' <waltj@fnal.gov>, 'Stephen Pordes' <stephen@fnal.gov>

Hi, Dr.Leo,

I went out there to PAB this morning and verified the corrective actions described here by Dan. Everything now looks OK. Thus I am recommending that this installation be issued the ORC. Thanks and good job on the documentation and the follow-through, Dan. It made things go a lot smoother.

Later,  
Steve Chappa

-----Original Message-----

From: Dan Edmunds [mailto:edmunds@pa.msu.edu]  
Sent: Wednesday, June 15, 2011 9:43 PM  
To: bellanto  
Cc: Steve Chappa; Eric D McHugh; 'Keith Schuh'; 'Walter Jaskierny'; Stephen Pordes  
Subject: Re: Bo Cold DAQ review findings

Hello,

Wednesday afternoon June 15th we had a safety review walk through of the "Cold Bo DAQ System" electronics. A number of problems were found. These problems were described in an earlier note from Steve Chappa. I have included clips from Steve's note below. The following indicates the steps that were taken late Wednesday afternoon to correct these problems.

1) On the WRP-16 PC board, the power output connector to the dewar has contacts that are rated for only 0.5 amps. The fuses installed for these outputs are rated for 1.0 amps. Thus, in a fault condition, the connector pin ratings will be exceeded. Require that the 1.0 amp fuses be replaced with 0.5 amp fuses (Dan already had them on hand). Since the operational current is about 200 mA, this reduction should be OK without causing nuisance blowing of fuses.

Action Taken: On all 9 WRP-16 cards the 4 1 Amp fuses on each card were replaced with 500 mA fuses. On the web the following documents were edited to indicate that a 500 mA fuse is the correct size to use in the WRP-16 cards: the Safety Review text document, the WRP-16 schematic, and the WRP-16 bill of materials.

2) The safety ground is not connected within the PreAmp power supply chassis (safety ground is provided externally). Also, the AC cord is a 3-prong plug. Require that a label be placed on the AC cord of the chassis and on the rear panel of the chassis (near the cord entrance) indicating that this safety ground is not used. This will alert the user to this reduction in electrical safety if the power supply is powered up independent of the LArPD installation.

Action Taken: These labels have been added to the PreAmp power supply. The labels say, "The Line Cord Safety Ground is NOT Connected to the Chassis of this Power Supply".

3) The outer jacket on the AC cord for the NIM crate cooling fan pack is cracked/damaged. This cord plug needs to be

replaced.

Action Taken: The existing plug and the cracked/damaged section of the power cord were cut off and a new plug installed.

- 4) Require some information, a description along with a sketch, of what is inside the custom-built HV filter canister (cooking pot).

The information that I can find about the HV filter is in the Bo LArTPC log book. Please go to the following web site and then click on the "Search" button that is along the left-hand edge near the top of the screen. Once the search menu opens up, type 1739 in the "Entry Number" field of the search menu and hit carriage return.

Log Book entry number 1739 from 2-May-2011 will then appear. This entry contains a description of the HV filter and a drawing of it. You need to click on the drawing to see it in full size.

The URL for the log book is:

<http://dbweb3.fnal.gov:8080/ECL/lartpc>

The HV filter consists of a 50 Meg Ohm HV resistor that is in oil. This resistor is in series with the center conductor of the HV coax cable. There is continuous continuity in the shield of the HV coax from the filter's input to its output.

The filter's input and output "connectors" consist of pipe flange plates with a short section of brass pipe screwed into each flange plate. The flange plates themselves are screwed to the top of the cooking pot. The center conductor of the HV coax enters the cooking pot through these brass pipes. Inside the cooking pot the center conductor of the HV coax is connected to the HV resistor. The shield of the HV coax cable is attached to the outer surface of the brass pipe with a hose clamps. The top of the cooking pot is attached to the body of the pot with 3 "C" clamps.

- 5) The terminals connecting the AC power cord to the 25KV power chassis shows signs of stress from the AC cord pulling on the crimp terminals. The copper conductor strands can be visually seen. Require that the cord terminals be disconnected from the chassis strip, insulate the terminal shrouds and conductors with heat-shrink tubing or tape, and then reconnect the cord with the cord properly strained relieved to the rack frame so the cord's weight will not pull directly on the terminals.

Action Taken: The power cord's 3 crimp on lugs were unscrewed from the barrier strip on the High Voltage power supply. Heat shrink tubing was applied that covers both the barrel section of each crimp on lug and also the first 3/4" of the wire that goes into each lug. The lugs were re-connected to the barrier strip and the insulating cover put back over the barrier strip. The power cord was then cable tied to a vertical rail in the rack so that there is no stress on the final section of the cable that runs to the HV supply.

- 6) There is an extension cord plugged into the stationary yellow rack power strip that is run under the edge of a plate at the bottom of the rack. This plate's edge, with the weight of the HV filter canister and some power cords on it, is directly cutting into the cord's outer jacket. Plus, this extension cord is then plugged into another cord used by a power strip that powers a turbo pump cart. Require that the extension cord be removed and

that a power strip with the proper length of cord (15-foot corded power strips are available) be plugged into the rack's power strip without the cord being under that plate.

Action Taken: Where the existing 10 foot extension cord enters the bottom of the yellow "HV & NIM rack" the aluminum plate was removed from being on top of this cord. The cord was examined in the area where it had been pinched under this plate and the insulation was not found to be cut or damaged (yet). At the far end of this extension cord the power outlet strip was removed and the pump cart was plugged directly into the extension cord.

We never need to operate both the window fan (the other item that had been plugged into the power outlet strip) and the pump cart at the same time. The pump is only used when the Bo cryostat is empty and being evacuated. The window fan is only used when the Bo cryostat is full of Liquid Argon.

7) Require that the grey rack, which is on unlocking rollers, be prevented from rolling since there are a couple of bench power supplies and some other lamp equipment that could easily fall off if their connecting cables and fibers are pulled.

Action Taken: The base of the gray "DAQ rack" was bolted to the base of the fixed position yellow "HV & NIM rack" with two 1/4"-20 bolts.

Items 8 through 12 in Steve's list were reviewed by the safety committee and found to be OK.

I believe that items 1 through 7 have been corrected and that the Bo Cold DAQ System is now ready to be re-inspected.

Thank you, Dan Edmunds

On Wed, 15 Jun 2011, bellanto wrote:

OK Thanks much Steve

What is the expected time frame for the fixes?

Leo

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Dr. Leo Bellantoni (630)730-2155  
MS 357, Fermilab Batavia, IL 60510

On Jun 15, 2011, at 4:35 PM, Steve Chappa wrote:

Hi Dr. Leo,

During the walk-through review of the 7B0? LArPD installation at PAB, I found:

1) On the WRP-16 PC board, the power output connector to the dewar has contacts that are rated for only 0.5 amps. The fuses installed for these outputs are rated for 1.0 amps. Thus, in a fault condition, the connector pin ratings will be exceeded. Require that the 1.0 amp fuses be replaced with 0.5 amp fuses (Dan already had them on hand. Since the operational current is about 200 mA, this reduction should be OK without causing nuisance blowing of fuses.

2) The safety ground is not connected within the PreAmp power supply

chassis (safety ground is provided externally). Also, the AC cord is a 3-prong plug. Require that a label be placed on the AC cord of the chassis and on the rear panel of the chassis (near the cord entrance) indicating that this safety ground is not used. This will alert the user to this reduction in electrical safety if the power supply is powered up independent of the LArPD installation.

3) The outer jacket on the AC cord for the NIM crate cooling fan pack is cracked/damaged. This cord plug needs to be replaced.

4) Require some information, a description along with a sketch, of what is inside the custom-built HV filter canister (cooking pot).

5) The terminals connecting the AC power cord to the 25KV power chassis shows signs of stress from the AC cord pulling on the crimp terminals. The copper conductor strands can be visually seen. Require that the cord terminals be disconnected from the chassis strip, insulate the terminal shrouds and conductors with heat-shrink tubing or tape, and then reconnect the cord with the cord properly strained relieved to the rack frame so the cord's weight will not pull directly on the terminals.

6) There is an extension cord plugged into the stationary yellow rack power strip that is run under the edge of a plate at the bottom of the rack. This plate's edge, with the weight of the HV filter canister and some power cords on it, is directly cutting into the cord's outer jacket. Plus, this extension cord is then plugged into another cord used by a power strip that powers a turbo pump cart. Require that the extension cord be removed and that a power strip with the proper length of cord (15-foot corded power strips are available) be plugged into the rack's power strip without the cord being under that plate.

7) Require that the grey rack, which is on unlocking rollers, be prevented from rolling since there are a couple of bench power supplies and some other lamp equipment that could easily fall off if their connecting cables and fibers are pulled.

8) The door to the yellow relay rack, with the HV label on it is removed. Require that the door be put back to limit access to the rear of the rack (due to the 25KV equipment) and for visual placement of the HV warning label. Done during the review. ?OK.

9) The system's safety ground 1/8 inch braid is sufficient for the fault current of the AC powering circuit (20-amp breaker). ?OK

10) The Glassman HV power supply has a maximum current limit of 16 mA. Sufficient protection is provided by keeping the rear door of the rack closed with the HV warning label placed on it. ?OK.

11) HV cables are also used from the NIM Droge (orange) power modules. The shields are properly grounded, either to the dewar metal or by using 200-ohm resistors from shield to system ground metal. ?OK.

12) The rest of the DC power paths are of proper size and fuse protected. ?OK.

When the required corrective actions are complete, Dan will notify us by email and then a visual confirmation will be needed of the corrections (due to the number of items listed). Once the corrections are confirmed, then the recommendation for the ORC can be given.

That is all I have.

Regards,  
Steve Chappa

From: Eric D McHugh <emchugh@fnal.gov>  
Subject: **FW: LAPD electronics walk through and document review for unattended operations**  
Date: June 20, 2011 8:17:30 AM CDT  
To: "edmunds@pa.msu.edu" <edmunds@pa.msu.edu>, "Stephen Pordes (stephen@fnal.gov)" <stephen@fnal.gov>  
Cc: Leo Bellantoni <bellanto@fnal.gov>, Keith Schuh <schuh@fnal.gov>, "Steve Chappa (chappa@fnal.gov)" <chappa@fnal.gov>, "Michael Lindgren (mlindgre@fnal.gov)" <mlindgre@fnal.gov>

Hello Dan and Stephen

The committee has given their recommendation for all portions of the electronics except the high voltage filter (aka bunny stew stock pot). It is very creative, but there is no information that leads the committee to believe that it is compliant to any code or standard.

1. The high voltage cable feed through. Metal pipe floor flanges are not intended to be used as bulkhead connectors for high voltage cables. Properly rated cable feed through fittings must be available. Hose clamps are being used to ground the shield of the cable these are not intended to be used as electrical connectors.
2. The cooking pot was not designed to be used as an enclosure for high voltage electrical equipment.
3. The safety ground braided cable being used is C clamped to the pot and holding the lid on the pot. The committee does not believe that the safety ground configuration meets the intent of NEC articles 250.96 "Bonding Enclosures" or 250.70 "Methods of Grounding or FESHM 5041 " Electrical Utilization Equipment Safety" in which Requirement #2 says "Whenever reasonably possible, electrical utilization equipment constructed by or for Fermilab shall utilize approved or listed components. Such components shall be utilized in accordance with the approval or listing."

The committee did not see any engineering documentation that indicates that the high voltage filter was designed to meet any standard or code requirement. If there are commercially available components they should be used or the filter removed prior to unattended operation. I can create the ORC document to cover a new commercial filter or the removal of the current stock pot filter. The current configuration is ok for proof of concept, but not unattended operations.

Thank you  
Eric McHugh

-----Original Message-----

From: Dan Edmunds [mailto:edmunds@pa.msu.edu]  
Sent: Monday, June 06, 2011 4:57 PM  
To: Eric D McHugh  
Cc: Leo Bellantoni; Steve Chappa; 'Keith Schuh'  
Subject: RE: LAPD electronics walk through and document review for unattended operations

Hello,

I just want to confirm that the walk through for the "Bo Cold DAQ System" at PAB will be on Wednesday June 15th at 1:30 PM.

If that is correct then I will be there. I will be driving down to Fermi that morning.

Thank you for setting up this review.

Dan

On Mon, 6 Jun 2011, Eric D McHugh wrote:

> Ah yes!!! We will meet at PAB!! Thanks Leo!

>

> From: Leo Bellantoni

> Sent: Monday, June 06, 2011 3:29 PM

> To: Steve Chappa

> Cc: Eric D McHugh; 'Keith Schuh'; edmunds@pa.msu.edu

> Subject: Re: LAPD electronics walk through and document review for  
> unattended operations

>

> I might be confused. I thought this stuff is going into "Bo" in the PAB.

>

Leo

>

> -----  
> Dr. Leo Bellantoni (630)730-2155

> MS 357, Fermilab Batavia, IL 60510

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> On Jun 6, 2011, at 3:23 PM, Steve Chappa wrote:

>

>

> Hi Eric,

> OK. See you then.

> Steve

>

> From: Eric D McHugh [mailto:emchugh@fnal.gov]

> Sent: Monday, June 06, 2011 3:18 PM

> To: Steve Chappa (chappa@fnal.gov<mailto:chappa@fnal.gov>); Keith Schuh;  
> 'edmunds@pa.msu.edu<mailto:'edmunds@pa.msu.edu>'

> Cc: Leo Bellantoni

> Subject: LAPD electronics walk through and document review for  
> unattended operations

>

> Hello Steve, Keith and Dan

> Let's have a walkthrough of the LAPD electronics at 1:30pm on the 15th. Does that work for everybody?  
> We will meet at PC4.

>

> Eric McHugh

> PPD/SSO

> x3199 or 708-514-4603

>

> Nothing is so important that it cannot be done safely.

>

>

>