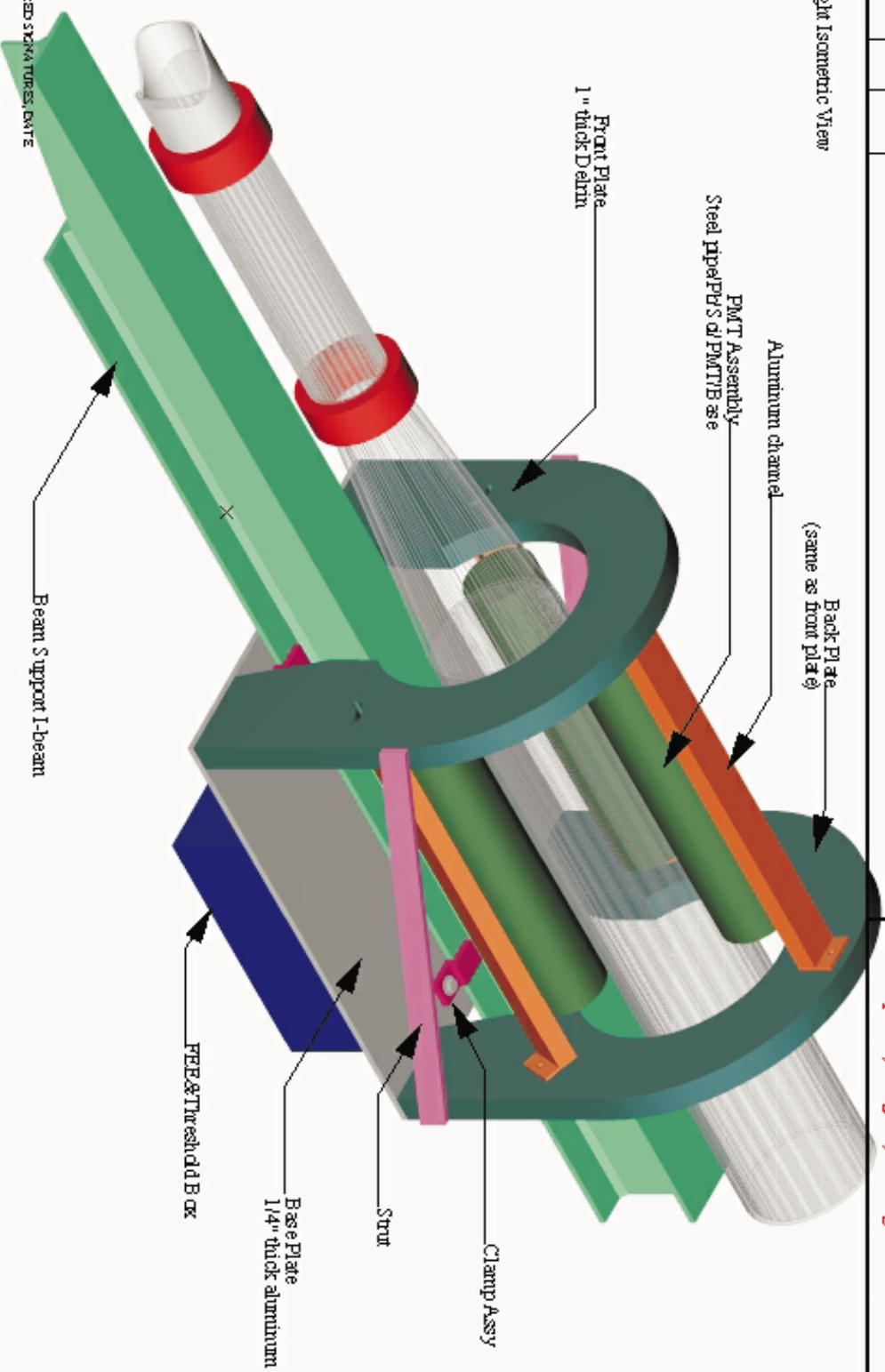


# pVPPD Safety Review

5/18/00, BNL

TDR DRAWING NUMBER REV. STAR DRAWING NUMBER <b>TOFIXXX</b>	REV. <b>H</b>	SHEET <b>1 of 1</b>	BNC DRAWING NUMBER PRODUCTION APP	REV. ALL DIMENSIONS INCHES DIAL CAT CODES/ISSUES
DRAWN BY <b>W. J. Llopis</b>	DATE <b>4/14/00</b>	CHECKED BY <b>BNC</b>	DATE 	DATE 
REV 	DWN 	CHR 	DATE 	
<b>T.W. BONNER NUCLEAR LABORATORY</b> RICE UNIVERSITY Houston, TX 77005-1892				
<b>STAR TOPp DETECTOR</b> MECHANICAL COMPONENTS				
<b>pVPPD, Design B, Pull Right Isometric View</b>				

Right Isometric View



REQUIRED SIGNATURES/DATE  
 PREPARATION MANAGER  
 PROJECT MANAGER  
 TECHNICAL DIRECTOR

## Safety Issues

### TOFp Safety Review. Dec 16, 1999

FR4?

Cooling Failure?

→ demonstrate T vs. t w/out cooling *or* interlock.  
...chose to interlock. (see Support Issues)

HVSys System Module?!?

- a Power Supply without U/L or equivalent certification
- action eventually passed to J. Curtiss, BNL

→ evaluate compliance vs. new stds from LLNL  
...“HVSys Compliance” document  
(see following pgs)

HVSys approved for operation in STAR pending  
on-site “installation review”...

### pVPD Safety Review. May 18, 2000

Another PMT-based system...  
External to STAR pole-tips, easily accessible...  
No cooling water path...  
1/10th the I & V draw on the relevant cables...  
FEE same as for TOFp...  
LV System same as for TOFp...  
Remote Threshold System same as for TOFp...  
Platform Electronics *are* TOFp's...

- HV supply and cabling not CW System like HVSys...
- Mounting...
- Field Effects...

# STAR-TOFp “HVSys” Compliance

*March 6, 2000*

The STAR Time-Of-Flight Patch (TOFp) uses a custom integrated system of Cockcroft-Walton bases to power the phototubes in the detector. This system is called “HVSys,” and detailed descriptions of the system and its specific implementation in STAR-TOFp can be found in Refs [1, 2, 3]. The system has been shown to meet all performance requirements.

The HVSys system was reviewed for its compliance with BNL Safety regulations on December 16, 1999 (see Ref. [2]). The only major issue that arose during this review concerns one component of this system, the so-called “System Module,” which is effectively a smart 200V power supply. This module is not U/L listed, nor has it been independently tested by a certified laboratory such as U/L. While the BNL regulations for certification of such a module for use in STAR are evolving at present, [4] it was requested that the manufacturer of the System Module address each of the points raised in Ref. [5]. The responses provided by V. Astakhov [6], the manufacturer of HVSys, are presented here.

## Contents

<b>1</b>	<b>Table I: Fabrication/Inspection Checklists</b>	<b>2</b>
1.1	Wiring/Fuse . . . . .	2
1.2	Marking/Labelling . . . . .	3
1.3	Enclosure Considerations . . . . .	3
1.4	Mechanical Considerations . . . . .	3
1.5	Chassis . . . . .	4
1.6	Cabinets . . . . .	4

From: "Curtiss, Joseph A" <curtiss@bnl.gov>  
To: "W.J. Llope" <llope@physics.rice.edu>  
Cc: "Christie, William" <christie@bnl.gov>  
Subject: RE: Re: more on bnl certification for hvsys  
Date: Mon, 6 Mar 2000 11:30:39 -0500

Bill --

Thanks for the rapid response. I see no safety problem with the power supply as an individual unit. I intend to call Christie for a briefing on the composite equipment, and I'd like to see the equipment in a later stage of installation so I can catch any problem while there is still time to conveniently make any corrections.

Please use this e-mail as your documentation.

-- Joe Curtiss

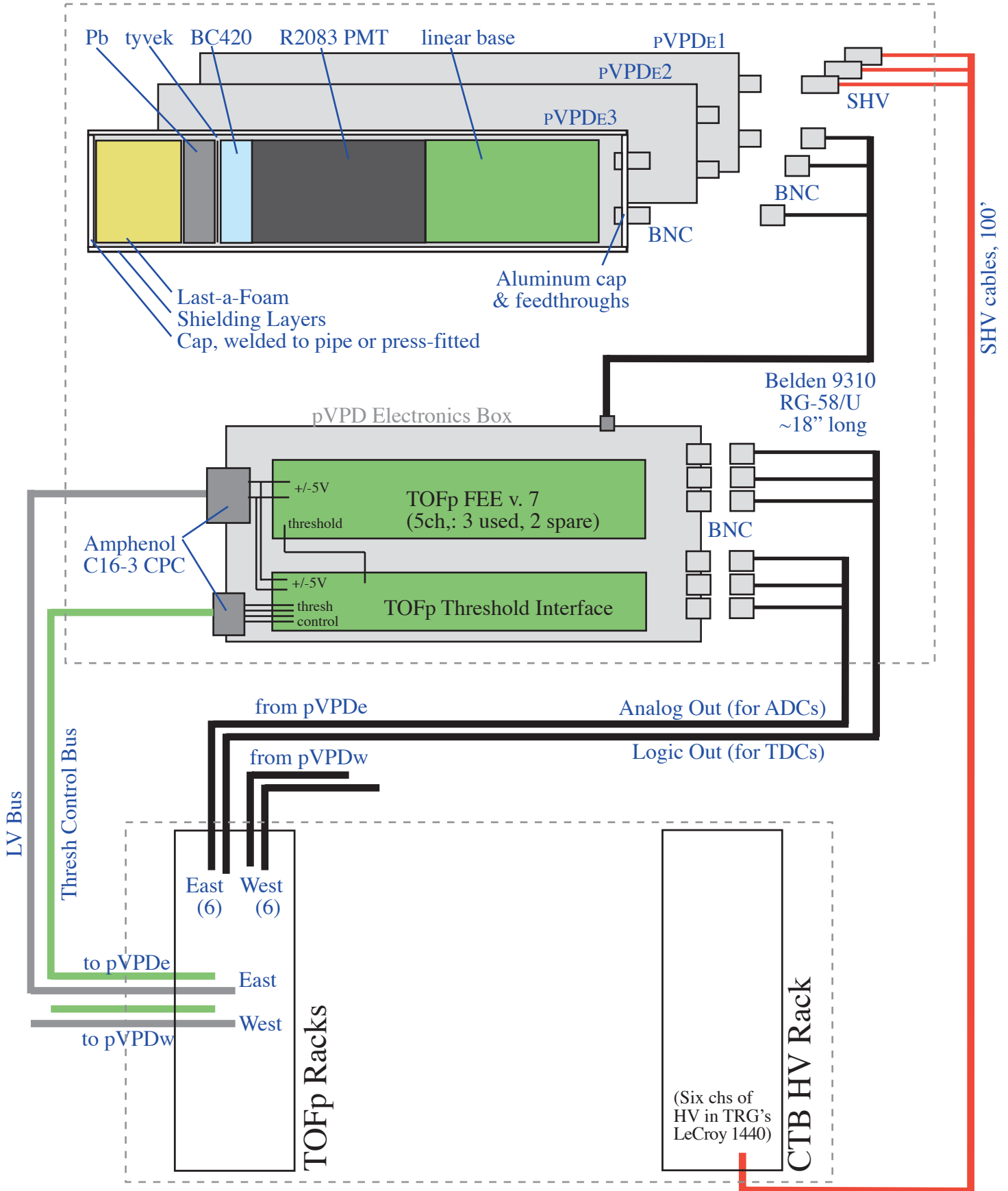
+++++

Date: Thu, 09 Mar 2000 17:58:46 -0500  
From: William Christie <christie@bnl.gov>  
Subject: Re: two questions?  
To: "W.J. Llope" <llope@physics.rice.edu>  
Cc: christie@bnl.gov  
Organization: Brookhaven National Laboratory  
X-Accept-Language: en

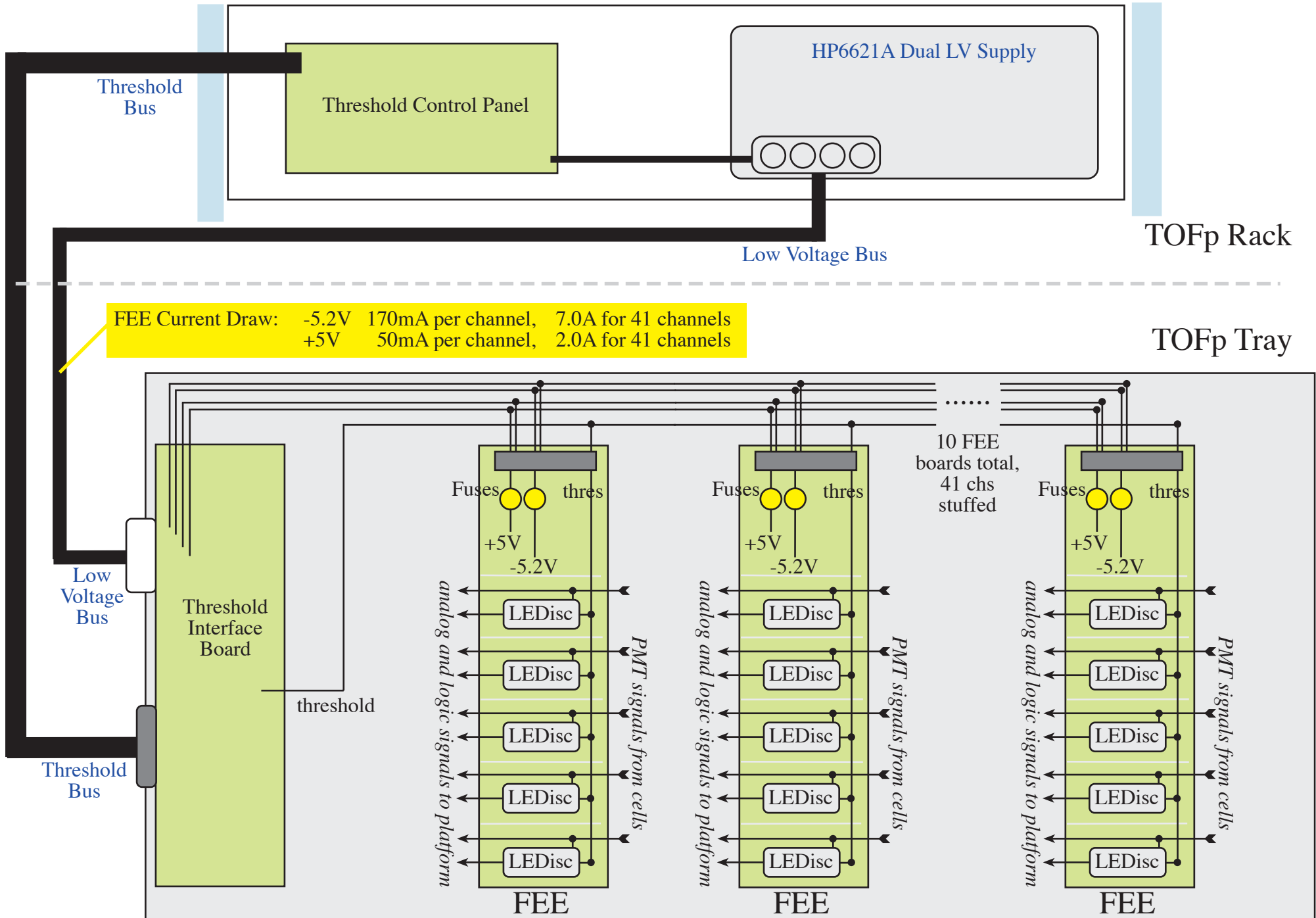
Bill,

I took Joe Curtiss on a grand tour of STAR today. He seemed duly impressed. At the end of the tour I asked if my understanding was correct that we/you had approval to use your Russian HV supply system. He indicated that this was correct.

pVPD Detector Assy (there are two of these: pVPDe and pVPDw)



# Low Voltage and Threshold System



TOFp DRAWING NUMBER REV.		STAR DRAWING NUMBER		REV.	SHEET #	RHIC DRAWING NUMBER		REV.	ALL DIMENSIONS ARE INCHES		<b>T.W. BONNER NUCLEAR LABORATORY</b> RICE UNIVERSITY    Houston, TX 77005-1892		
		<b>TOF090</b>		<b>H</b>	1 of 1					<b>STAR TOFp DETECTOR</b>			
DRWN BY	W.J. Llope	DATE	1/26/00	COGNIZANT ENG	DATE	PRODUCTION APP	DATE	CAT.CODE/WBS		<b>MECHANICAL COMPONENTS</b>			
REV.	DWN.	CHK.	DATE	revised PC dimensions, requiring LV panels to go to space in a second rack								<b>TOFp Rack Contents</b>	
1	WJL	WJL	3/14/00										

**TOFp/pVPD Rack1 Contents**

- 5U Breaker Panel
- 15U SM255 Mount, Rice Ramp, and Free Space
- 5U NIM crate (2)
- 7U CAMAC crate
- 1U Kinetics 1992
- 4U Patch Panel
- 1U Fan (4)
- 1U Open (2)

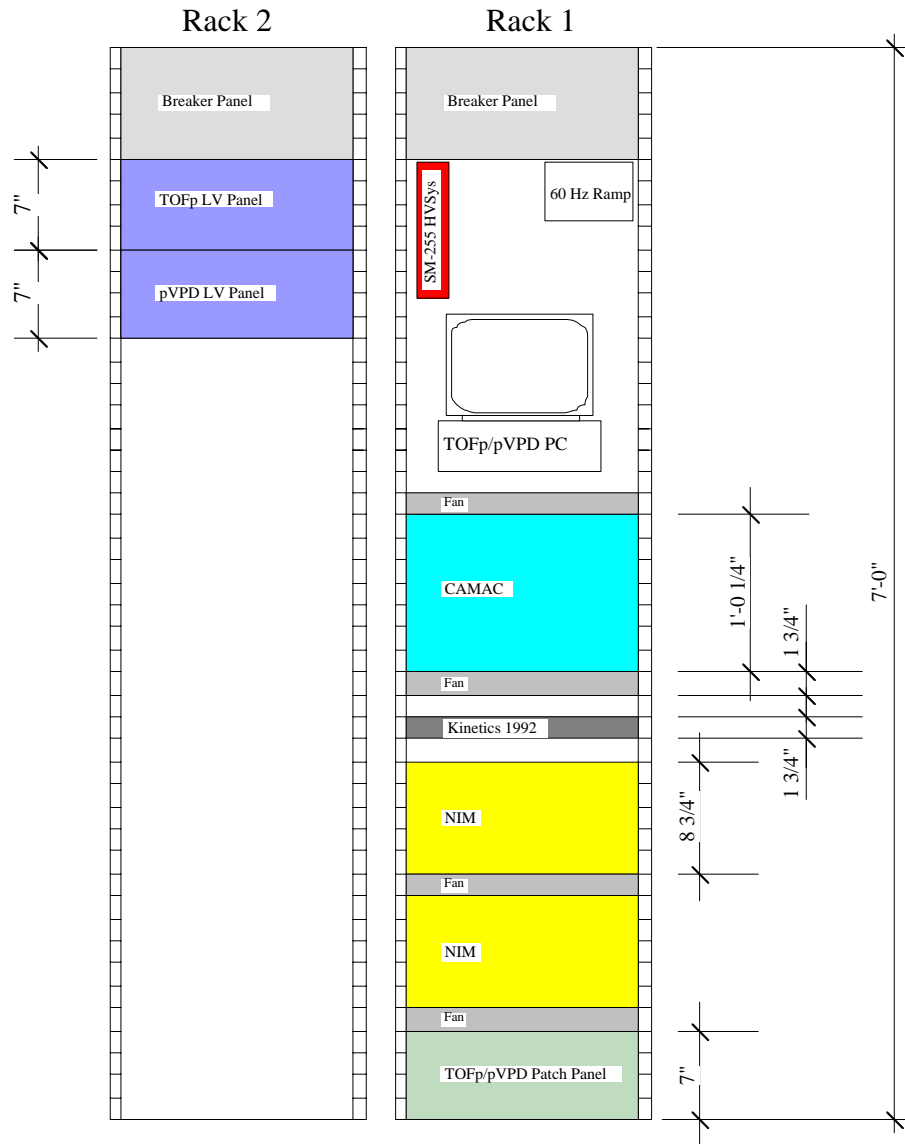
-----  
**48U**

**TOFp/pVPD Rack2 Contents**

- 4U TOFp LV Panel
- 4U pVPD LV Panel

-----  
**8U**

Rack1 and Rack2 do not have to be next to each other.....



REQUIRED SIGNATURES, DATE

INTEGRATION MANAGER \_\_\_\_\_

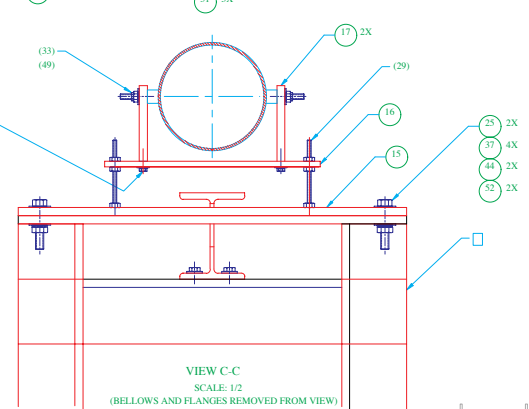
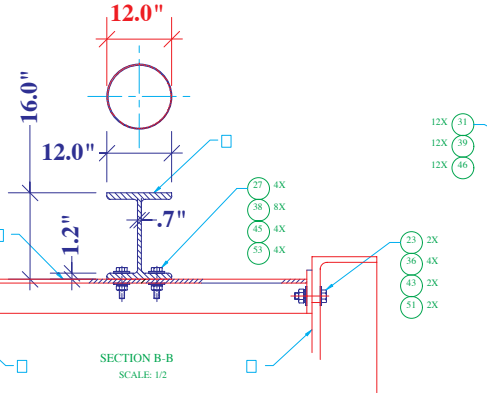
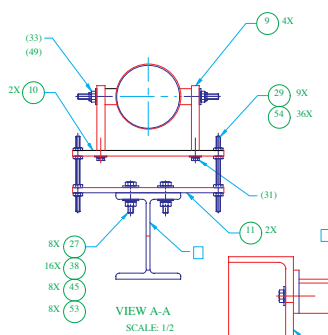
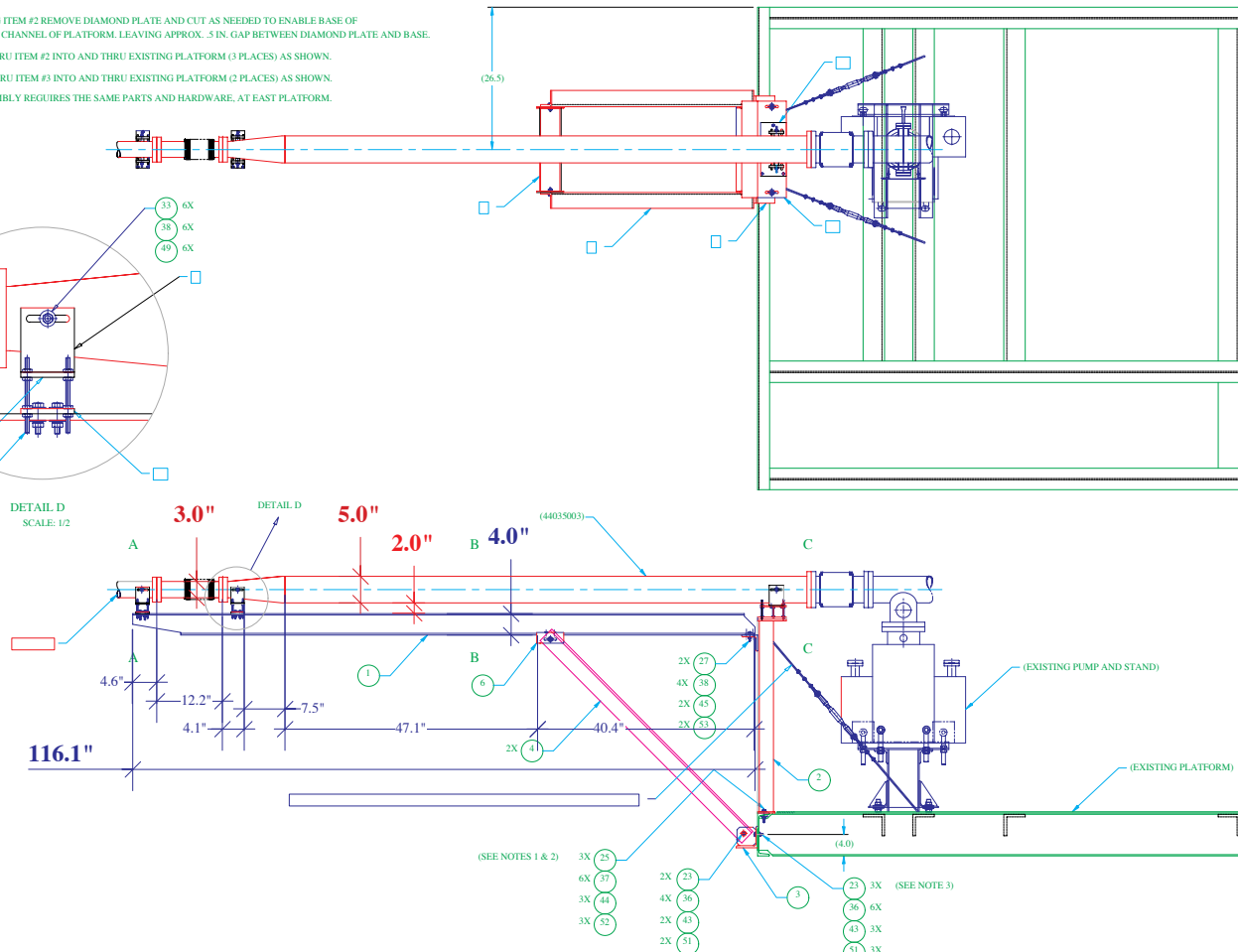
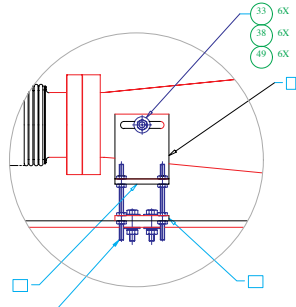
PROJECT MANAGER \_\_\_\_\_

TECHNICAL DIRECTOR \_\_\_\_\_

\_\_\_\_\_

NOTES:

- BEFORE INSTALLING ITEM #2 REMOVE DIAMOND PLATE AND CUT AS NEEDED TO ENABLE BASE OF ITEM #2 TO SIT ON CHANNEL OF PLATFORM. LEAVING APPROX. .5 IN. GAP BETWEEN DIAMOND PLATE AND BASE.
- TRANSFER DRILL THRU ITEM #2 INTO AND THRU EXISTING PLATFORM (3 PLACES) AS SHOWN.
- TRANSFER DRILL THRU ITEM #3 INTO AND THRU EXISTING PLATFORM (2 PLACES) AS SHOWN.
- EAST SUPPORT ASSEMBLY REQUIRES THE SAME PARTS AND HARDWARE, AT EAST PLATFORM.



54	36	-	NUT, PLAIN HEX, 10-32NF	SST	
53	14	-	NUT, PLAIN HEX, .250-20NC	SST	
52	5	-	NUT, PLAIN HEX, .375-16NC	SST	
51	7	-	NUT, PLAIN HEX, .312-18NC	SST	
50	-	-	-	-	
49	6	91839A029	NUT, LOCK, .25-20NC	SST	M&M MASTER-CARR
48	-	-	-	-	
47	-	-	-	-	
46	12	-	WASHER, LOCK, 0.190 SCR SIZE	SST	
45	14	-	WASHER, LOCK, 0.250 SCR SIZE	SST	
44	5	-	WASHER, LOCK, 0.375 SCR SIZE	SST	
43	7	-	WASHER, LOCK, 0.312 SCR SIZE	SST	
42	-	-	-	-	
41	-	-	-	-	
40	-	-	-	-	
39	12	-	WASHER, FLAT, 0.190 SCR SIZE	SST	
38	34	-	WASHER, FLAT, 0.250 SCR SIZE	SST	
37	10	-	WASHER, FLAT, 0.375 SCR SIZE	SST	
36	14	-	WASHER, FLAT, 0.312 SCR SIZE	SST	
35	-	-	-	-	
34	-	-	-	-	
33	6	-	ROD, CONT. THRD, .25-20NC X 1.75 LG	SST	
32	-	-	-	-	
31	12	-	SCR, HEX HD, 10-32NF X .75 LG.	SST	
30	-	-	-	-	
29	9	-	ROD, CONT. THRD, 10-32NF X 3.5 LG.	SST	
28	-	-	-	-	
27	14	-	SCR, HEX HD, .250-20NC X 1.5 LG.	SST	
26	-	-	-	-	
25	5	-	SCR, HEX HD, .375-16NC X 2.0 LG.	SST	
24	-	-	-	-	
23	7	-	SCR, HEX HD, .312-18NC X 1.5 LG.	SST	
22	-	-	-	-	
21	-	-	-	-	
20	-	-	-	-	
19	-	-	-	-	
18	-	-	-	-	
17	2	CNV936-B-1	SUPPORT BLOCK 2		
16	1	CNV935-B-1	BLOCK PLATE 2		
15	1	CNV934-B-1	PLATE, SUPPORT WELDMENT		
14	-	-	-	-	
13	-	-	-	-	
12	-	-	-	-	
11	2	CNV933-B-1	CHANNEL PLATE		
10	2	CNV932-B-1	BLOCK PLATE 1		
9	4	CNV931-B-1	SUPPORT BLOCK 1		
8	-	-	-	-	
7	-	-	-	-	
6	1	CNV930-C-1	CHANNEL SUPPORT WELDMENT		
5	-	-	-	-	
4	2	CNV929-B-1	SUPPORT ANGLE		
3	1	CNV928-C-1	ANGLE SUPPORT WELDMENT		
2	1	CNV927-C-1	SUPPORT WELDMENT		
1	1	CNV926-C-1	SUPPORT BEAM		

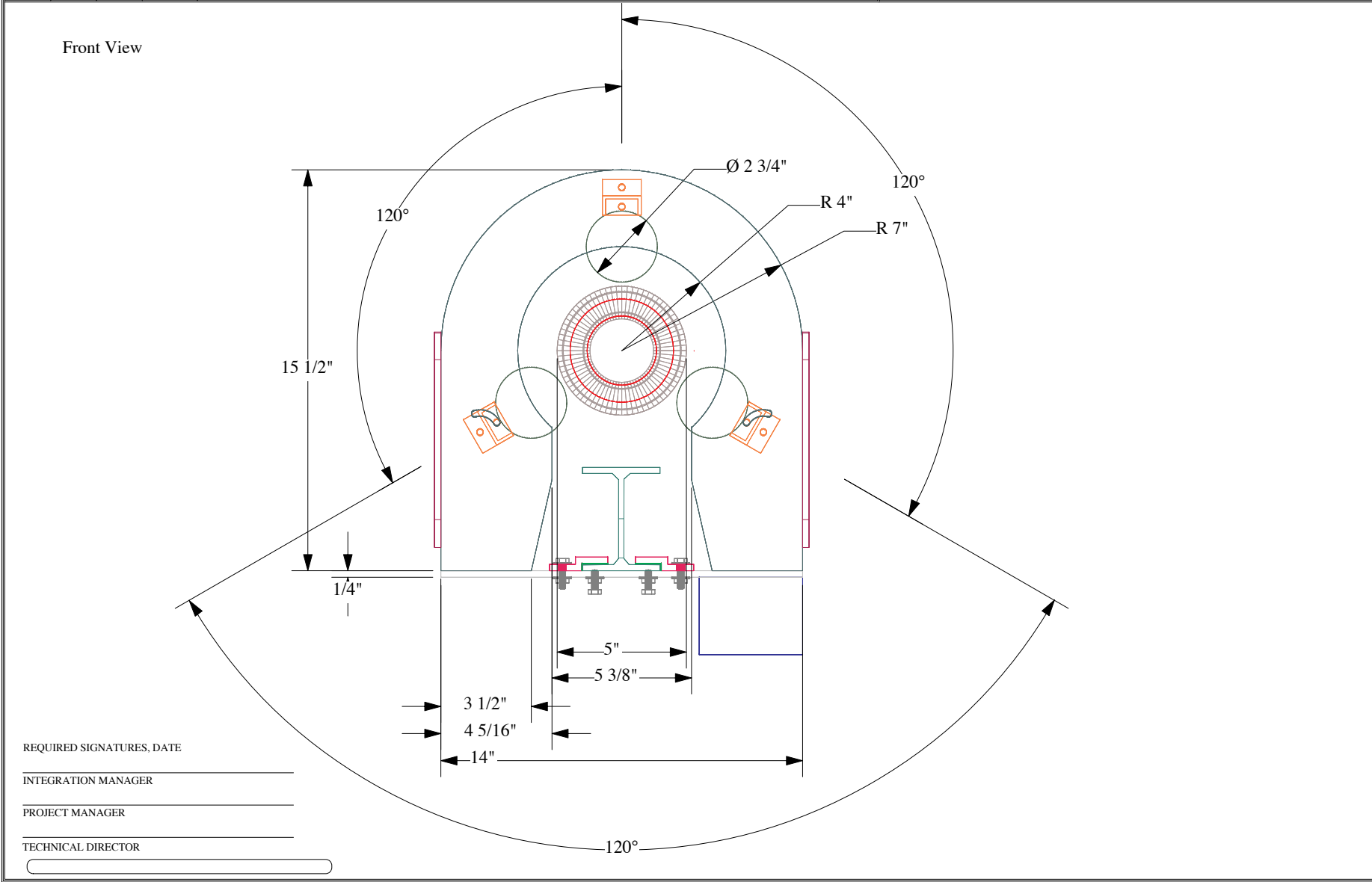
ITEM NO.	QTY	PART NUMBER	DESCRIPTION	REMARKS
			PARTS LIST	



TOFp DRAWING NUMBER REV.		STAR DRAWING NUMBER REV.		SHEET #		RHIC DRAWING NUMBER REV.		ALL DIMENSIONS ARE INCHES [CM]	
		<b>TOFxxx</b>		<b>H</b>		<b>1of1</b>			
DRWN BY <b>W.J. Llope</b>		DATE <b>4/14/00</b>		COGNIZANT ENG		DATE		PRODUCTION APP	
REV.	DWN.	CHK.	DATE					CAT.CODE/WBS	

**T.W. Bonner Nuclear Laboratory**  
RICE UNIVERSITY Houston, TX 77005-1892

**STAR TOFp DETECTOR**  
**MECHANICAL COMPONENTS**  
**pVPD, Design B, Full Front View**

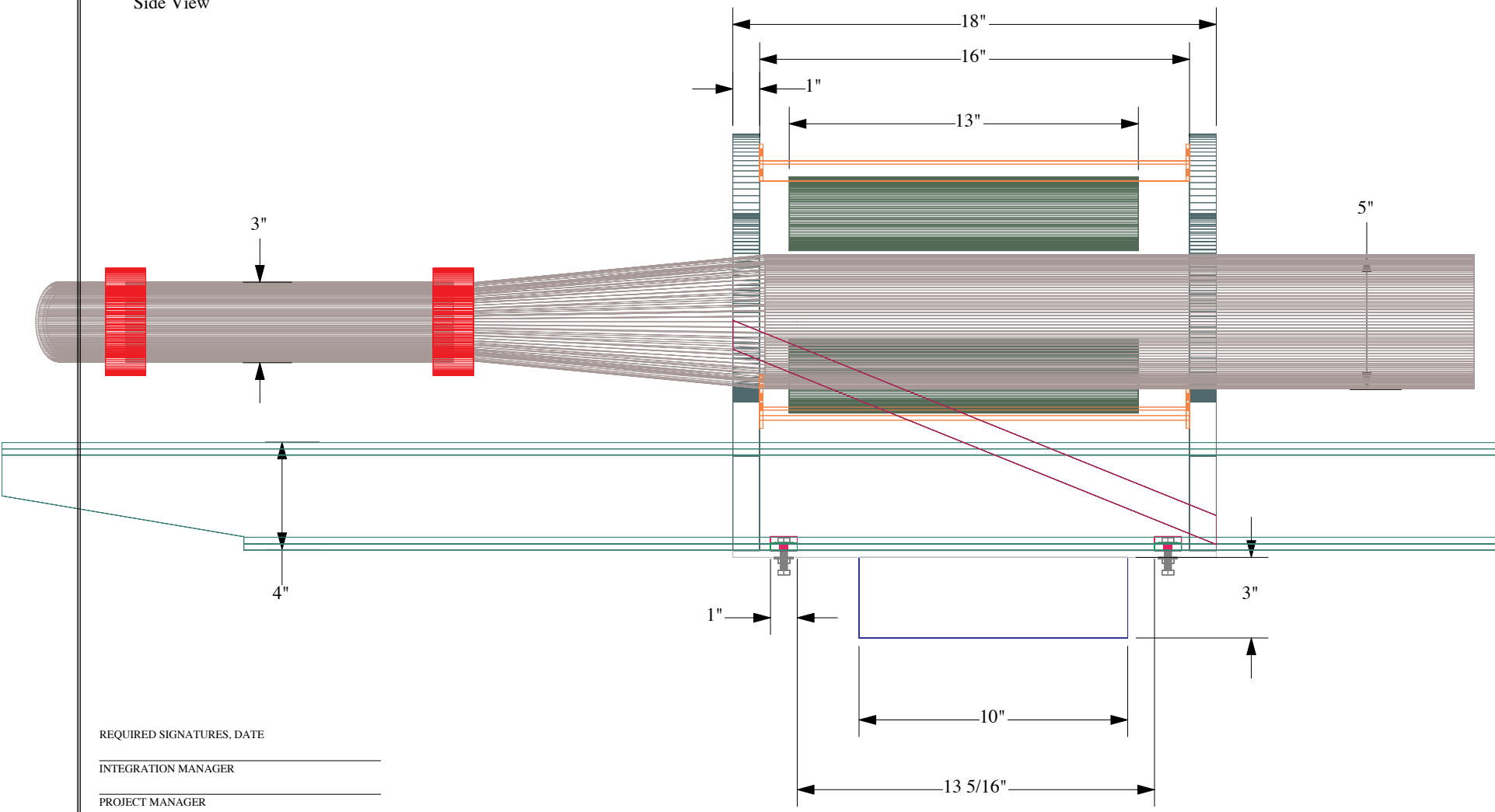


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DRWN BY		DATE		COGNIZANT		DATE		PRODUCTION APP		CAT.CODE/WBS	
W.J. Llope		4/14/00		ENG							
REV.	DWN.	CHK.	DATE								

T.W. Bonner Nuclear Laboratory  
RICE UNIVERSITY Houston, TX 77005-1892

STAR TOFp DETECTOR  
MECHANICAL COMPONENTS  
**pVPD, Design B, Full Side View**

Side View



REQUIRED SIGNATURES, DATE

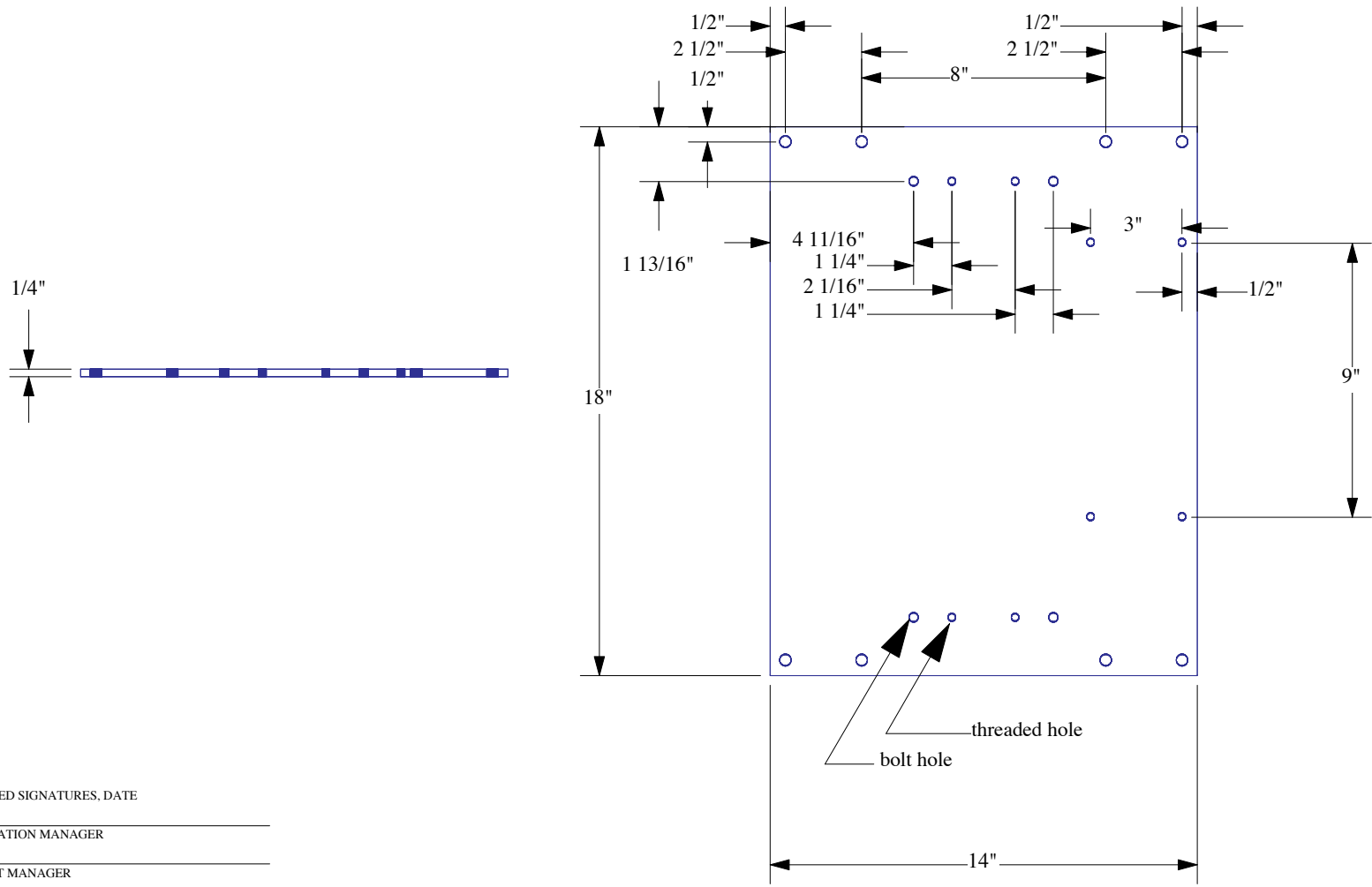
INTEGRATION MANAGER \_\_\_\_\_

PROJECT MANAGER \_\_\_\_\_

TECHNICAL DIRECTOR \_\_\_\_\_

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TOFp DRAWING NUMBER	REV.	STAR DRAWING NUMBER	REV.	SHEET #	RHIC DRAWING NUMBER	REV.	ALL DIMENSIONS ARE INCHES [CM]	<b>T.W. Bonner Nuclear Laboratory</b> RICE UNIVERSITY Houston, TX 77005-1892	
		<b>TOFxxx</b>	<b>H</b>	<b>1 of 1</b>					
DRWN BY	DATE	COGNIZANT	DATE	PRODUCTION	DATE	CAT.CODE/WBS			
W.J. Llope	4/14/00	ENG		APP					
REV.	DWN.	CHK.	DATE						STAR TOFp DETECTOR
									MECHANICAL COMPONENTS
									<b>pVPD, Design B, Base Plate</b>



REQUIRED SIGNATURES, DATE

INTEGRATION MANAGER \_\_\_\_\_

PROJECT MANAGER \_\_\_\_\_

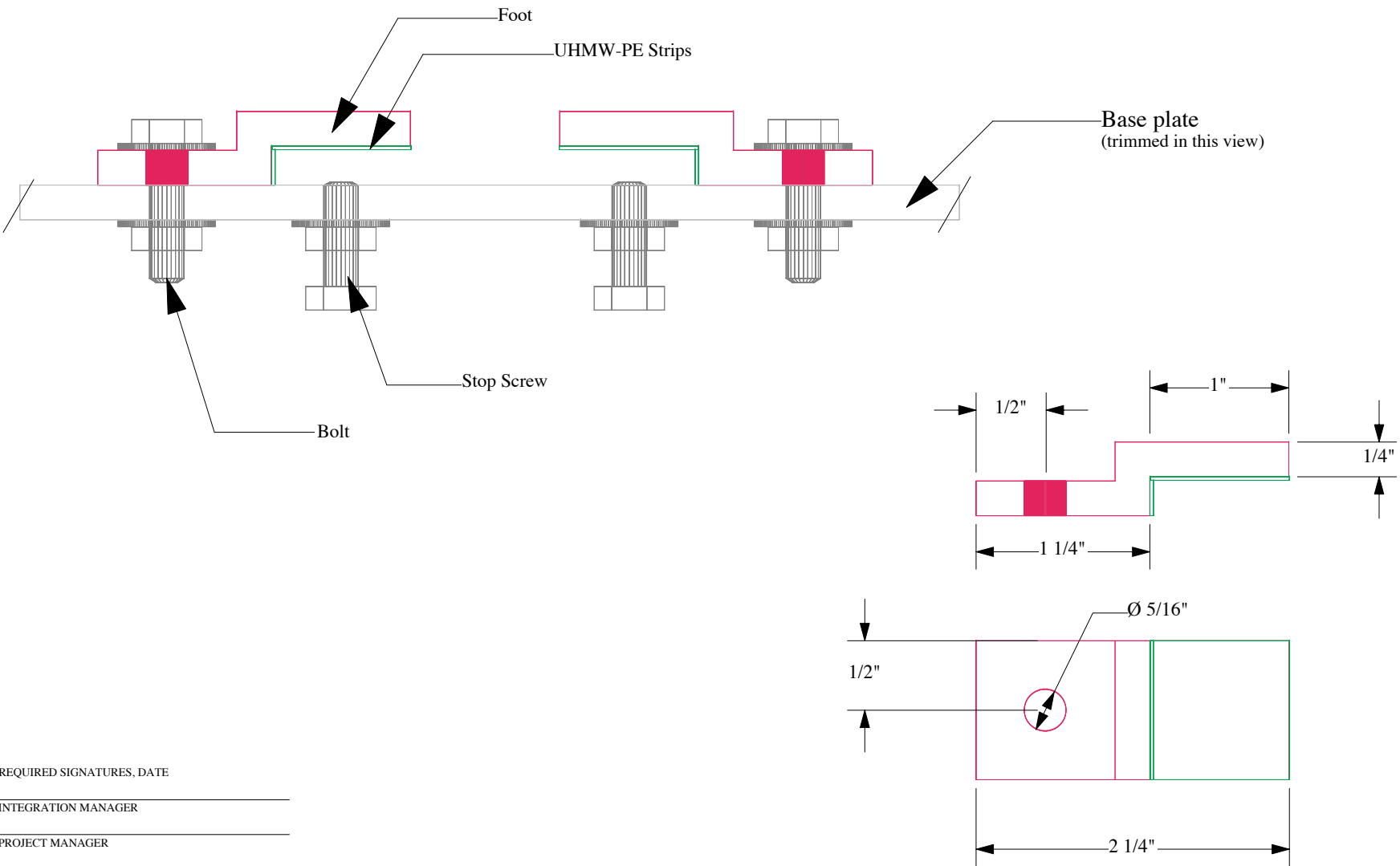
TECHNICAL DIRECTOR \_\_\_\_\_

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DRWN BY	W.J. Llope		DATE	4/14/00		COGNIZANT ENG	DATE	PRODUCTION APP	DATE	CAT.CODE/WBS
REV.	DWN.	CHK.	DATE							

**T.W. Bonner Nuclear Laboratory**  
RICE UNIVERSITY Houston, TX 77005-1892

**STAR TOFp DETECTOR**  
**MECHANICAL COMPONENTS**  
**pVPD, Design B, Clamp Assy**



REQUIRED SIGNATURES, DATE

INTEGRATION MANAGER \_\_\_\_\_

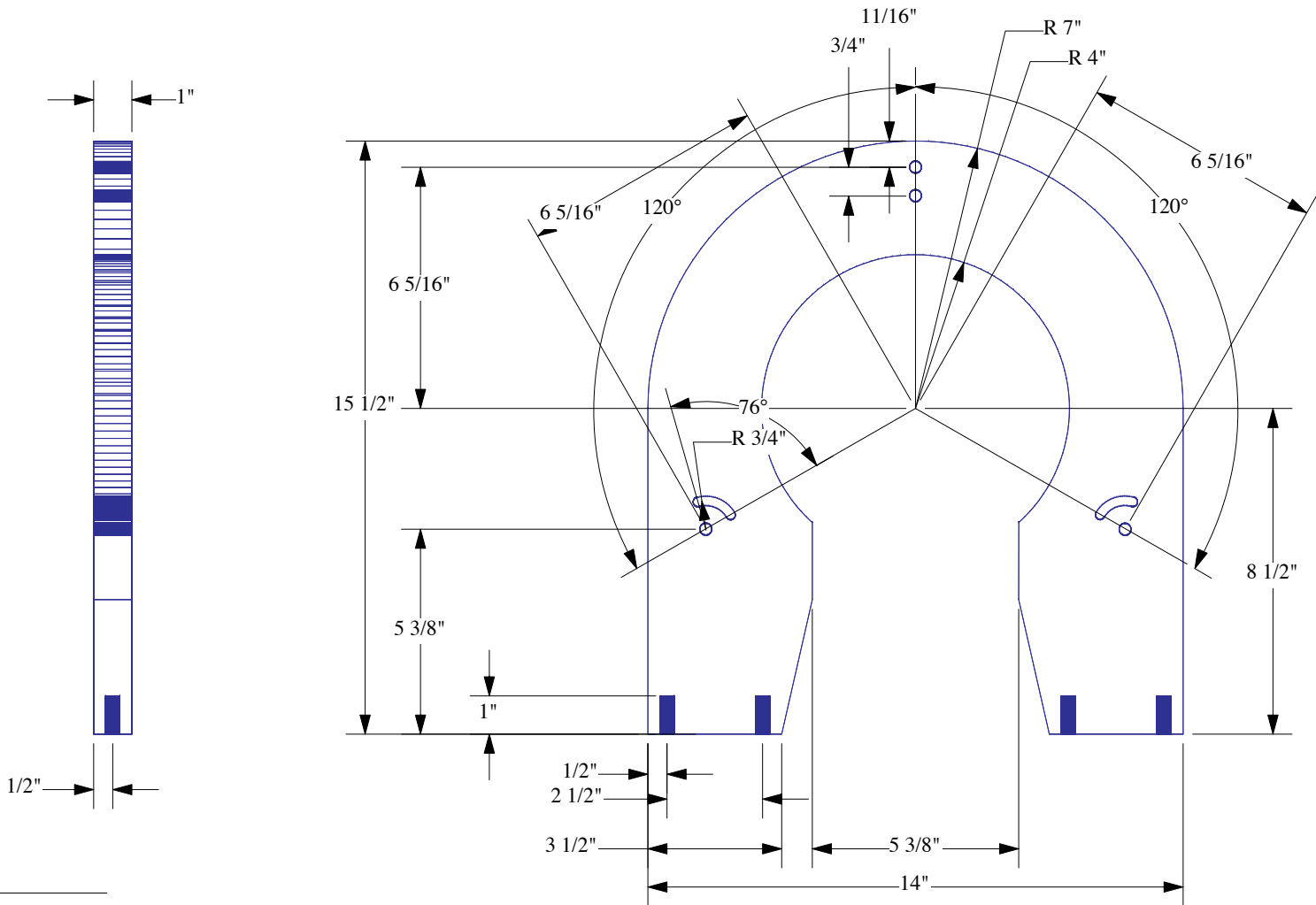
PROJECT MANAGER \_\_\_\_\_

TECHNICAL DIRECTOR \_\_\_\_\_

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DRWN BY		DATE		COGNIZANT		DATE		PRODUCTION		CAT.CODE/WBS	
W.J. Llope		4/14/00		ENG				APP			
REV.	DWN.	CHK.	DATE								

**T.W. Bonner Nuclear Laboratory**  
RICE UNIVERSITY Houston, TX 77005-1892

**STAR TOFP DETECTOR**  
**MECHANICAL COMPONENTS**  
**pVPD, Design B, Front Plate and Back Plate**

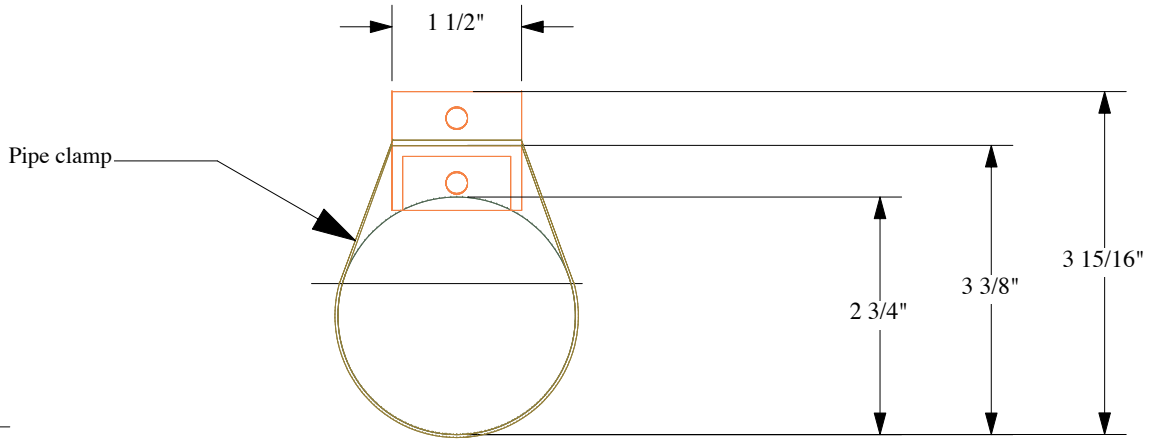
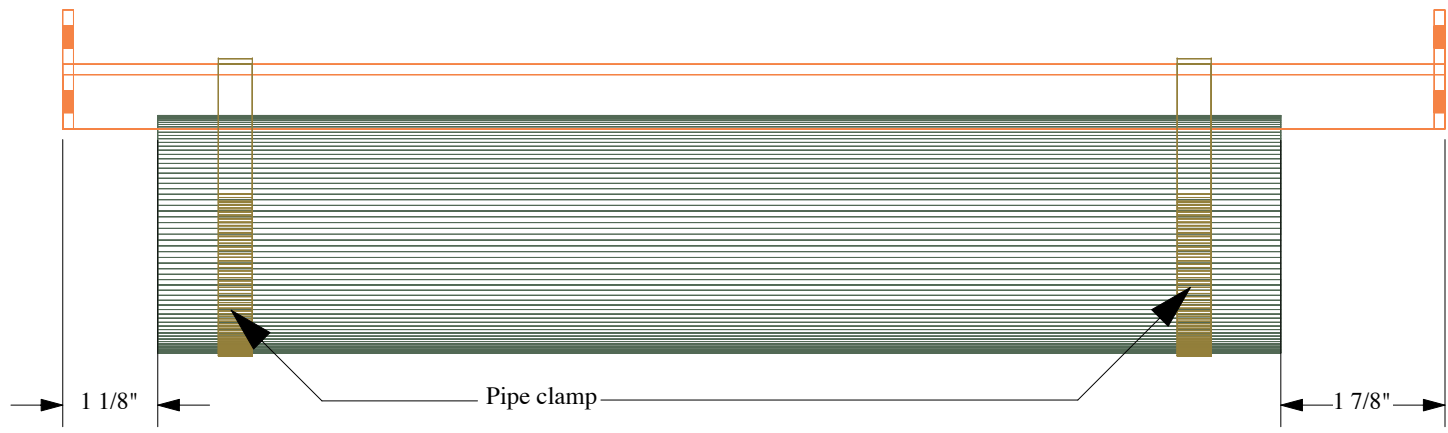


REQUIRED SIGNATURES, DATE  
\_\_\_\_\_  
INTEGRATION MANAGER  
\_\_\_\_\_  
PROJECT MANAGER  
\_\_\_\_\_  
TECHNICAL DIRECTOR  
\_\_\_\_\_

TOF <sub>p</sub> DRAWING NUMBER REV.		STAR DRAWING NUMBER <b>TOFxxx</b>		REV. <b>H</b>	SHEET # <b>1of1</b>	RHIC DRAWING NUMBER REV.		ALL DIMENSIONS ARE INCHES [CM]	
DRWN BY <b>W.J. Llope</b>		DATE <b>4/14/00</b>		COGNIZANT ENG	DATE	PRODUCTION APP	DATE	CAT.CODE/WBS	
REV.	DWN.	CHK.	DATE						

**T.W. Bonner Nuclear Laboratory**  
RICE UNIVERSITY Houston, TX 77005-1892

**STAR TOF<sub>p</sub> DETECTOR**  
**MECHANICAL COMPONENTS**  
**pVPD, Design B, Boat & PMT Assy**



REQUIRED SIGNATURES, DATE

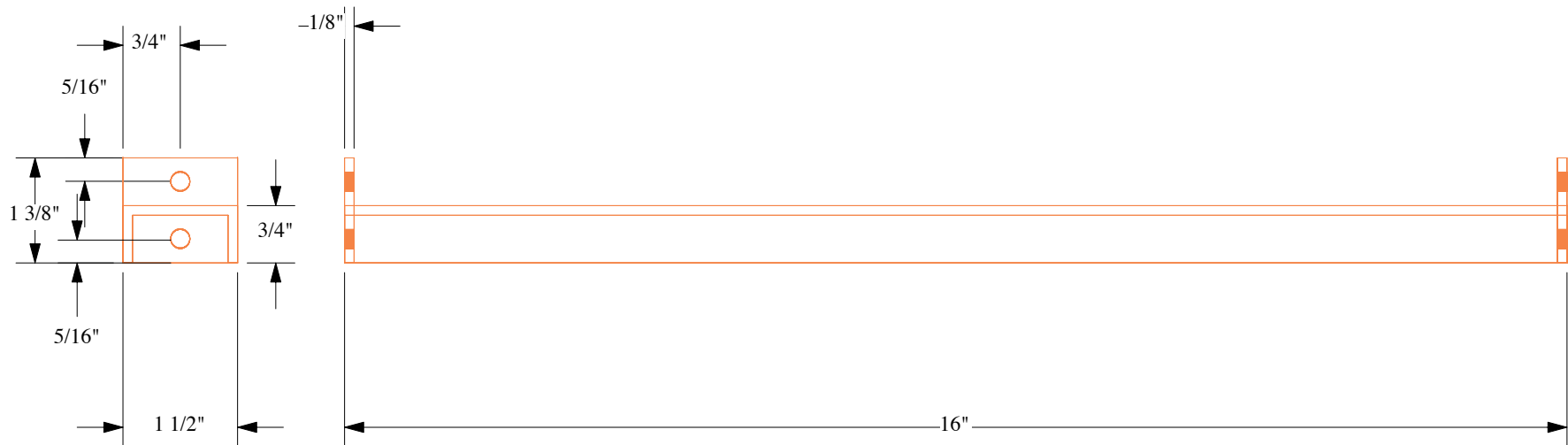
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INTEGRATION MANAGER

\_\_\_\_\_  
PROJECT MANAGER

\_\_\_\_\_  
TECHNICAL DIRECTOR

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TOFp DRAWING NUMBER REV.		STAR DRAWING NUMBER REV.		SHEET #		RHIC DRAWING NUMBER REV.		ALL DIMENSIONS ARE INCHES [CM]		T.W. Bonner Nuclear Laboratory RICE UNIVERSITY Houston, TX 77005-1892	
DRWN BY W.J. Llope		DATE 4/14/00		COGNIZANT ENG		DATE		PRODUCTION APP		CAT.CODE/WBS	
REV.	DWN.	CHK.	DATE								
										STAR TOFp DETECTOR	
										MECHANICAL COMPONENTS	
										pVPD, Design B, Boat	



REQUIRED SIGNATURES, DATE

INTEGRATION MANAGER \_\_\_\_\_

PROJECT MANAGER \_\_\_\_\_

TECHNICAL DIRECTOR \_\_\_\_\_

\_\_\_\_\_

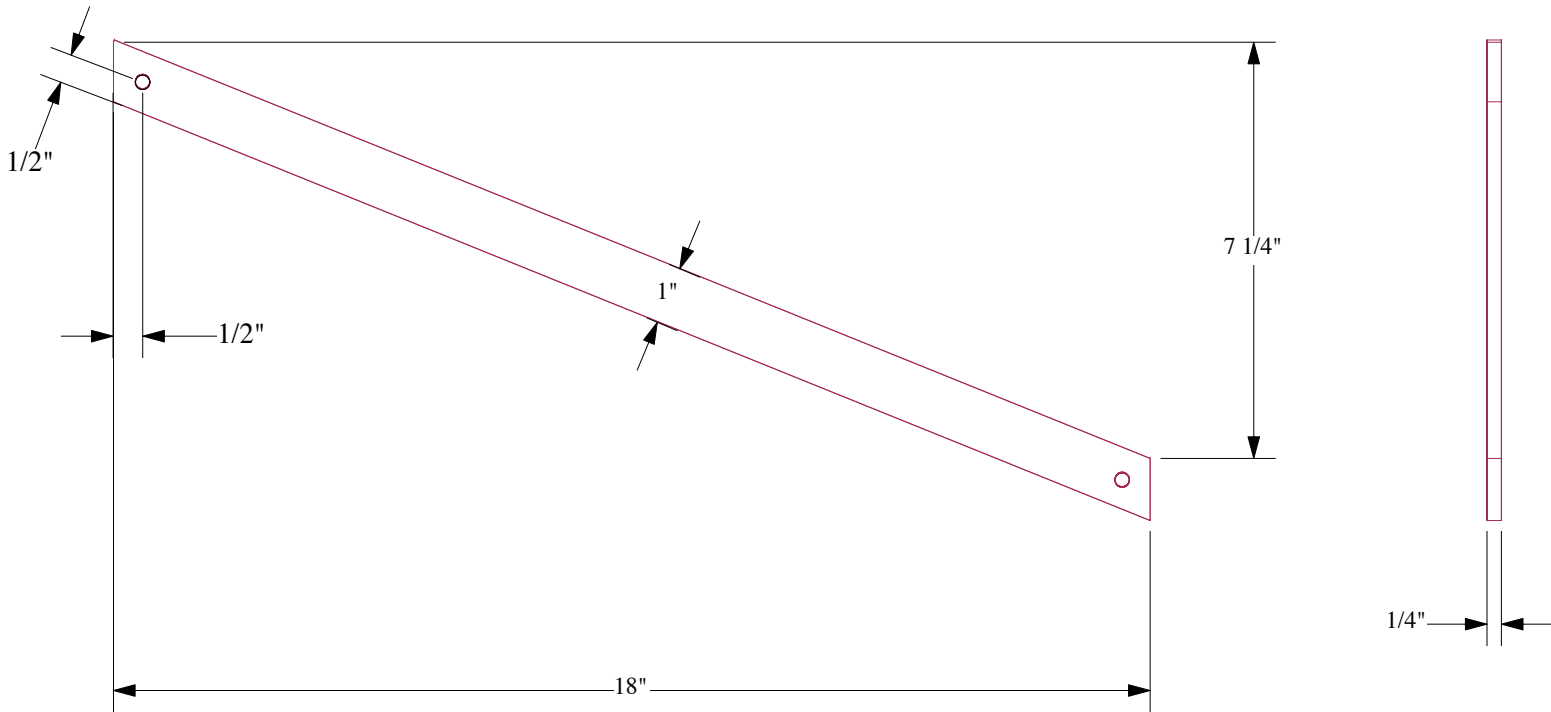
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DRWN BY		DATE		COGNIZANT ENG		DATE		PRODUCTION APP		DATE		CAT.CODE/WBS			
W.J. Llope		4/14/00													
REV.	DWN.	CHK.	DATE												

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RICE UNIVERSITY Houston, TX 77005-1892

**STAR TOF<sub>p</sub> DETECTOR**

**MECHANICAL COMPONENTS**

**pVPD, Design B, Strut**



REQUIRED SIGNATURES, DATE

INTEGRATION MANAGER \_\_\_\_\_

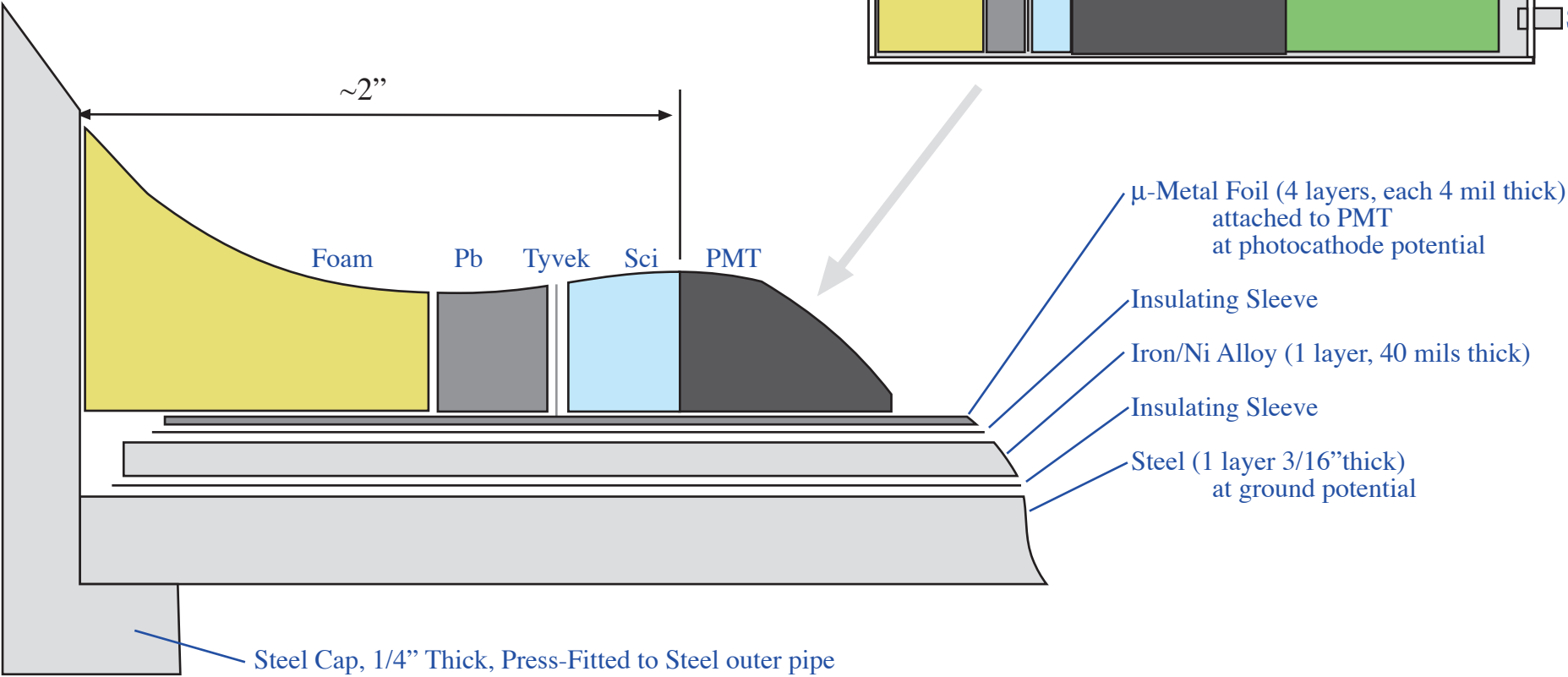
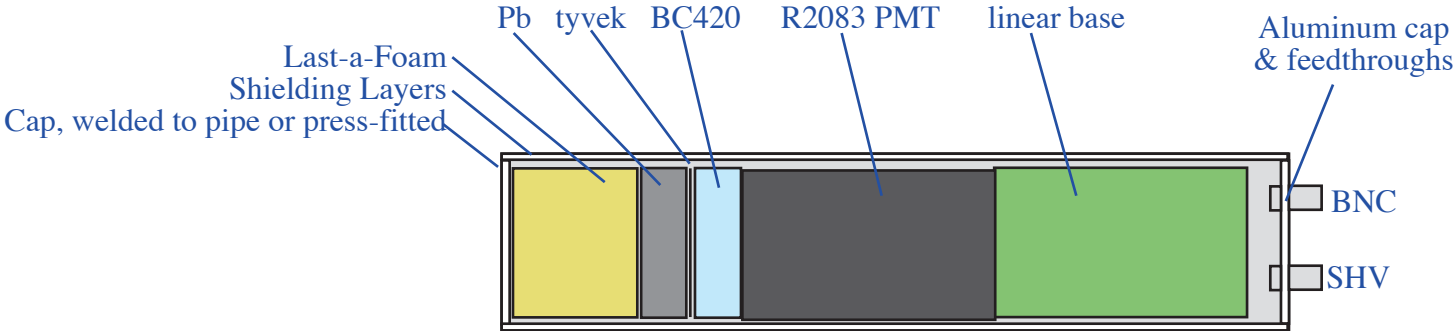
PROJECT MANAGER \_\_\_\_\_

TECHNICAL DIRECTOR \_\_\_\_\_

\_\_\_\_\_



# Shielding



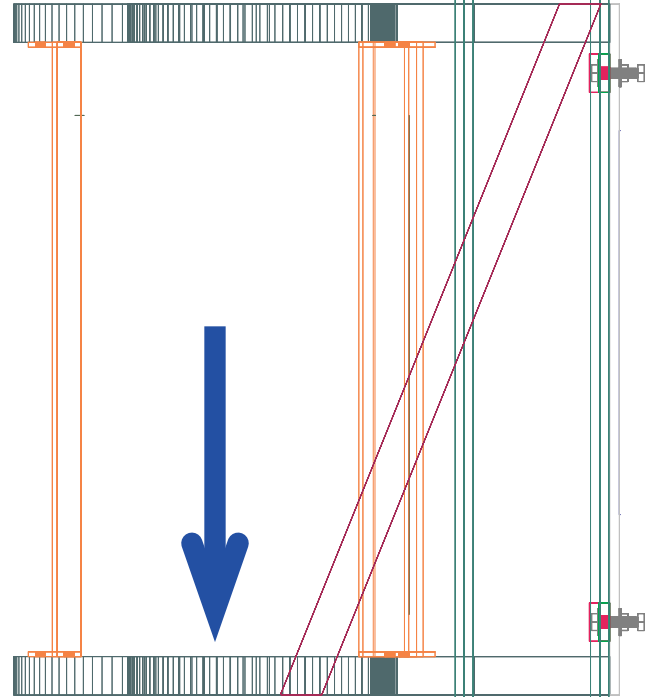
# Loading Tests

Each PMT Assy weighs ~10 lbs  
3 PMT Assys weigh 30 lbs

Field at 4.5m = ~500 G  
Gradient

$dB/dz \sim 10 \text{ G/cm}$  @  $|Z| \sim 4.25\text{m}$   
 $dB/dz \sim 4 \text{ G/cm}$  @  $|Z| \sim 4.75\text{m}$

Expect magnetic forces ~1g, or ~30 lbs  
(Ken Foley)



get short section of 4" I-beam like the actual beam pipe support  
rotate that I-beam 90 degrees...  
and bolt it to a wall...

mount superstructure onto I-beam exactly as pVPD goes on real I-beam

measure all cross-dimensions

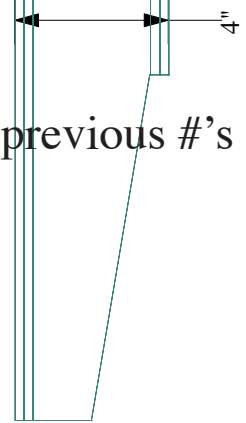
put 60 lb weight on to the front plate...

(twice times the weight of the 3 shields per Det Assy)

→ show Clamp Assy lock-down of base plate remains solid

→ remeasure all cross-dimensions. look for any differences w.r.t. previous #'s

report results



## pVPD Installation Procedure (Draft)

01. Turn STAR magnetic field on.
02. Measure field with simple probe at 1-2 locations on back of FTFC.
03. Turn STAR magnetic field off.
04. Install Base Plate to underside of I-beam using Clamp Assy hardware.
05. Tighten down lock screws to secure Z position of Base Plate.
06. Lower detector superstructure from above onto Base Plate, and bolt down.
07. RHIC surveys pipe location and repositions to compensate for (~0.05") sag.
08. RHIC removes the pipe wrap ("permanently").
09. Rotate two lower PMT Assys down and into position, and lock down.
10. Install FEE Box and cabling between FEE box and PMT Assys.
11. Install cabling from pVPD Det Assy to Platform (TOFp Racks and CTB HV Rack).
12. Install proper Lock-Out/Tag-Out documentation and obtain clearance to power up pVPD.
13. Turn STAR magnetic field on.
14. Measure field with probe at same locations on back of FTFC, and compare to prev. values.