BROOKHAVEN NATIONAL LABORATORY

Work Permit # SDD-2016-11/SS-2016-
Work Order # ___
Job# ___ **Activity#** ___

See "Instructions for Filling out the Work Permit" contained in the Work Planning and Control for Experiments and Operations Subject Area.

1. Work request WCC fills out this section. ☐ **Standing Work Permit**

Requester: Don Lynch	Date: 7/14/2016	Ext.: 2253	Dept/Div/Group: PO/PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Don Lynch		Start Date: 7/15/2016	Est. End Date: 12/31/2016
Brief Description of Work: Removal and Repurposing of MPC-Ex Detector subsystem (North and South)			
Building: 1008	Room: IR	Equipment: MPC-eX	Service Provider: PHENIX technicians and MPC-Ex experts

2. WCC, Requester/Designee, Service Provider, and ESSH (as necessary) fill out this section or attach analysis

ESSH ANALYSIS

Radiation Concerns	☒ None	☐ Activation	☐ Airborne	☐ Contamination	☐ Radiation	☐ NORM	☐ Other
☐ Special nuclear materials involved, notify Isotope Special Materials Group				☐ Fissionable/Radiological materials involved, notify Laboratory Nuclear Safety Officer			
Radiation Generating Devices:	☐ Radiography		☐ Moisture Density Gauges	☐ Soil Density Gauges		☐ X-ray Equipment	

Safety and Security Concerns	☐ None	☐ Explosives	☐ Transport of Haz/Rad Material	☐ Pressurized Systems
☐ Adding/Removing Walls or Roofs	☐ Critical Lift	☐ Fumes/Mist/Dust*	☐ Magnetic Fields*	☐ Railroad Work
☐ Asbestos*	☐ Cryogenic	☐ Heat/Cold Stress	☐ Nanomaterials/particles*	☒ Rigging
☐ Beryllium*	☐ Electrical	☐ Hydraulic	☐ Noise*	☐ Silica*
☐ Biohazard*	☒ Elevated Work	☐ Lasers*	☐ Non-ionizing Radiation*	☐ Security Concerns
☐ Chemicals/Corrosives*	☐ Excavation	☐ Lead*	☐ Oxygen Deficiency*	☐ Suspect/Counterfeit Items
☐ Confined Space*	☐ Ergonomics*	☒ Material Handling	☐ Penetrating Fire Walls	☐ Vacuum
Ladder Access Required: ☐ Portable Ladder ☐ Fixed Ladder– Status/Restrictions:				
* Safety Health Rep. Review Required	☐ Haz, Rad, Bio Material Exceed DOE 151.1-C Levels - Contact OEM			☒ Other: work near beampipe

Environmental Concerns	☒ None	☐ Work impacts Environmental Permit No.	
☐ Atmospheric Discharges (rad/non-rad/GHG)	☐ Land Use Institutional Controls	☐ Soil Activation/contamination	☐ Waste-Mixed
☐ Chemical or Rad Material Storage or Use	☐ Liquid Discharges	☐ Waste-Clean	☐ Waste-Radioactive
☐ Cesspools (UIC)	☐ PCB Management	☐ Waste-Hazardous	☐ Waste-Regulated Medical
☐ High water/power consumption	☐ Spill potential	☐ Waste-Industrial	☐ Historical Enviornmental Hazards
Waste disposition by:			☐ Other
Pollution Prevention (P2)/Waste Minimization Opportunity: ☐ No ☐ Yes		Environmental Preferable Products Available: ☐ No ☐ Yes	

FACILITY CONCERNS	☒ None	☐ Intermittent Energy Release		
☐ Access/Egress Limitations	☐ Electrical Noise	☐ Potential to Cause a False Alarm		☐ Vibrations
☐ Credited Controls (Use USI Process)	☐ Impacts Facility Use Agreement		☐ Temperature Change	☐ Other
☐ Configuration Management	☐ Maintenance Work on Ventilation Systems		☐ Utility Interruptions	

WORK CONTROLS

Work Practices

☐ None	☐ Exhaust Ventilation	☒ Lockout/Tagout	☐ Spill Containment	☐ Security (see Instruction Sheet)
☒ Back-up Person/Watch	☐ HP Coverage	☐ Posting/Warning Signs	☐ Time Limitation	☐ Other
☐ Barricades	☐ IH Survey	☒ Scaffolding-requires inspection	☐ Warning Alarm (i.e. "high level")	☐ Electrical Inspection Required

Personal Protective Equipment

☐ None	☐ Ear Plugs	☒ Gloves, as necessary	☐ Lab Coat	☒ Safety Glasses, where req'd
☐ Coveralls	☐ Ear Muffs	☐ Goggles	☐ Respirator*	☐ Safety Harness
☐ Disposable Clothing	☐ Face Shield ☐ Hard Hat	☐ Shoe Covers	☒ Safety Shoes, as req'd	☐ High visibility cloths/vest ☐ Other

Permits Required (Permits must be valid when job is scheduled.)

☒ None	☐ Cutting/Welding	☐ Impair Fire Protection Systems
☐ Concrete/Masonry Penetration	☐ Digging/Core Drilling	☐ Rad Work Permit-RWP No
☐ Confined Space Entry	☐ Electrical Working Hot	☐ Other

Dosimetry/Monitoring

☒ None	☐ Heat Stress Monitor	☐ Real Time Monitor	☐ TLD
☐ Air Effluent	☐ Noise Survey/Dosimeter	☐ Self-reading Pencil Dosimeter	☐ Waste Characterization
☐ Ground Water	☐ O_2/Combustible Gas	☐ Self-reading Digital Dosimeter	☐ Other
☐ Liquid Effluent	☐ Passive Vapor Monitor	☐ Sorbent Tube/Filter Pump	

Training Requirements (List specific training requirements)

CA –Collider User, PHENIX Awareness,

Work screening has identified the following as the reason for permitted work:	**When work is categorized as worker planned work and a permit is used only the following signatures are required: (Although allowed, there is no need to use back of form)**	
☐ **ESSH**	WCC:	Date:
☒ **Complexity**	Service Provider:	Date:
☐ **Work Coordination**	Authorization to start:	Date:
☐ **Permit Not Required** (Sections 3 through 7 optional)	(Department/Division, or their equivalent, Sup/WCC/Designee)	

3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)

Work Plan (procedures, timing, equipment, scheduling, coordination, notifications, and personnel availability need to be addressed in adequate detail): See attached Procedure
Special Working Conditions Required (e.g., Industrial Hygiene hold points or other monitoring) None
Notifications to operations and Operational Limits Requirements: No
Post Work Testing, Notification or Documentation Required: See Attached Plan

Job Safety Analysis Required: ☐ Yes ☒ No	Review Done: ☒ in series ☐ team

Reviewed by: * Primary Reviewer signature (not required for Worker Planned Work) means that the Review Team members were appropriate for the work that was planned, the Team visited the job site, hazards and risks that could impact ESSH have been considered and controls established according to BNL requirements. In addition, this signature indicates that applicable JRAs, FRAs, as well as other planning documents have been reviewed and training requirements have been identified and recorded on this permit.

Title	Name (print)	Signature	Life #	Date
ES&H Professional				
F&O Facility Project Manager				
Service Provider				
Work Control Coordinator	Don Lynch		20146	
Safety Health Representative				
Research Space Manager				
Other				
Other				
Required Walkdown Completed				
*Primary Reviewer				

4. Job site personnel (Supervisor and workers) fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments) and all training required for this permit is current/complete. Job Supervisor/Contractor Supervisor signatures also includes verification that worker training required for this permit is current/complete.

Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:

Workers are encouraged to provide feedback on ESSH concerns or on ideas for improved job work flow. Use feedback form or space below.

5. Department/Division, or their equivalent, Line Manager or Designee

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)

Name:	Signature:	Life#:	Date:

6. Worker provides feedback.

Worker Feedback (use attached sheets as necessary)

a) WCM/WCC: Are there any changes as a result of worker feedback? ☐ Yes ☐ No

Note: See Work Planning and Control for Experiments and Operations Subject Area section 2.6.

7. Post Job Review/Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of job site to work supervisor.) The WCC ensures that the change process to update drawings, placards, postings, procedures, etc., is initiated, if necessary.

Name:	Signature:	Life#:	Date:
Comments:			

Attachment to W.P. #SDD-2016-09/SS-2016 July 13, 2016

MPC-Ex

Introduction

The Muon Piston Calorimeter (MPC) Extension, or MPC-EX, is a Si-W preshower detector that will be installed in front of the existing PHENIX MPC's in both the north and the south Muon Magnets. This detector consists of eight layers of Si "minipad" sensors interleaved with tungsten absorber and enables the identification and reconstruction of $\pi 0$ mesons at energies up to ~80 GeV.

The PHENIX Collaboration will remove and disposition (store until ultimate disposition is determined) this detector subsystem during the 2016 PHENIX Removal and Repurposing (R&R) shutdown after run 16. This document describes the work plan to remove and store the full complement of 2 stations (north and south) for the detector.

MPC-Ex Design

(Please see the attached Assembly and Installation Plan for illustrations of the following design, assembly and installation descriptions, which, taken in reverse, may be a helpful reference for worker planned aspects of this removal process.)

The MPC-Ex design consists of 8 layers (plates) of 2.0 mm thick tungsten spaced 4.5 mm apart. There are upper and lower halves to the MPC-Ex and north and south stations in the north and south Muon Magnets, respectively. On to each tungsten plate a carrier board is adhered. To each carrier board 12 micromodules consisting of a minipad silicon sensor sandwiched and glued between a ceramic base and a Dual SVX-4 Readout Card. The card is then wirebonded to the silicon sensor. On the side farthest from the PHENIX IP, a Delrin plate will be attached provide a light tight closure beyond the last layer of carrier board.

Assembly of the MPC-Ex detectors requires gluing fixtures for the micromodules and for the carrier board/tungsten plate lamination.

The 8 layers are stacked up and spaced using threaded rods and threaded spacers, then the upper and lower ends are capped with support covers. Low voltage distribution boards are mechanically attached to the upper and lower support covers. Each Carrier board has power connections between itself and the LV distribution board and bias voltage connections. The LV distribution boards have power and communication cables to a control racks mounted on the north and south MuTrigger racks.

In addition, each carrier board has 2 ribbon cable pig tails which connect via a 2 meter ribbon cable to a front end module. The front end module in turn connects back to the control rack via flat LVDS cable. Communication from the rack room to the MPC-Ex

control racks will be via fiber optic cables.

Removal of the MPC-Ex detectors will require scaffolding, a custom designed insertion/installation tool, and a rigging fixture to lift the upper and lower halves onto the insertion/installation tool.

Removal Procedures

MPC-Ex Detector Final Assembly

Assemble Upper and Lower halves of MPC-Ex in accordance with MPC-Ex Assembly drawing (drawing # 105-0219-119 attached). (worker planned work).

MPC-Ex Detector Installation

(Note: Scaffolding for installation of MPC-Ex was designed and installed for Muon Tracker work in previous and current shutdowns. Installation of this scaffolding is worker planned work and will be performed and approved by qualified and trained PHENIX technicians and BNL carpenters. Design drawings of the scaffolding and all appropriate approval paperwork is provided with this work permit. The scaffolding to be used is designated as "Station 1" scaffolding.

MPC-Ex South Station

1. After the Muon Magnet South (MMS) and Central Magnet (CM) have been separated by moving the MMS to its south most position in accordance with the PHENIX procedure PP-2.5.5.1-01-C to gain access to South MPC-Ex, PHENIX technicians and BNL bargaining unit carpenters shall erect the Station 1 scaffolding per the attached drawing # 105-0500-092-A. ***Note: A copy of the attached agreement between PHENIX and the IBEW (attached) allowing PHENIX Techs to work cooperatively with IBEW carpenters to erect the scaffolding described herein shall be prominently posted at the worksite along with a copy of this work permit.***
2. After the scaffolding is erected, it shall be inspected by a qualified scaffold inspector prior to use for any purpose, and the attached scaffold inspection check sheet (or appropriate check list card) shall be filled out and signed by the inspector.

3. The inspector shall attach the scaffold check list to the scaffold indicating its suitability for use.

4. The scaffold shall be inspected daily by a qualified person before use. The scaffold check list attached to the scaffold may be used to record the inspection date and approval.

5. After any changes are made to the scaffolding, the check list must be removed and the scaffold re-inspected by a qualified scaffold inspector and items 2 and 3 above repeated.

This scaffolding shall be used for the MPC-Ex work described below, but it may also be used for RPC1, BBC and work in station 1 south during the 2016 R&R effort. Work for those subsystems shall be planned and documented separately, except that the scaffold use documentation described herein shall suffice for all of these projects. Work planning for those projects shall reference this work permit to describe scaffold work planning.

6. When work has been completed in station 1 south the scaffolding shall be disassembled and removed from station 1 south to allow repositioning of the CM magnet.

7. With the Muon Magnet South (MMS) in its southmost position The CM magnet shall be moved south in accordance with PHENIX procedure PP-2.5.5.1-01-C to open access to MPC-Ex North.

8. Steps 1 thru 6 above shall be followed to erect, inspect and modify the station 1 scaffolding as necessary to accomplish MuTr work described above.

This scaffolding shall be used for the MuTr work described above, but it may also be used for RPC1, BBC, MPC and MPC-Ex work in station 1 north during the 2014 shutdown. Work for those subsystems shall be planned and documented separately, except that the scaffold use documentation described herein shall suffice for all of these projects. Work planning for those projects shall reference this work permit to describe scaffold work planning.

After completion of all work requiring the use of the station 1 scaffolding, the scaffolding shall be disassembled and stored in its storage container which shall be suitably stowed to protect against damage and/or deterioration until it is next needed. Steps 1-8 above are the basic operations of worker planned work to erect, disassemble and relocate the Station 1 scaffolding in its 2 locations and may be necessary to perform several times in each of its designated locations to accommodate specific other work taking place in the PHENIX IR.

9. Affix temporary beampipe support to beampipe in station 1
10. Remove all cables, fibers and cooling lines.
11. Remove front end module(s) on magnet sides.
12. Remove existing beampipe support
13. Install MPC-Ex insertion/installation tool
14. Extract MPC-Ex from piston hole.
15. Using MPC-Ex lifting fixture, remove upper and lower MPC-Ex detector halves from insertion/installation device with mount mounting tabs
16. Contact BNL Health Physics to test all removed components for activation
17. Relocate removed components to BNL Physics Department MPC Lab
18. Remove station 1 scaffolding

MPC-Ex North Station

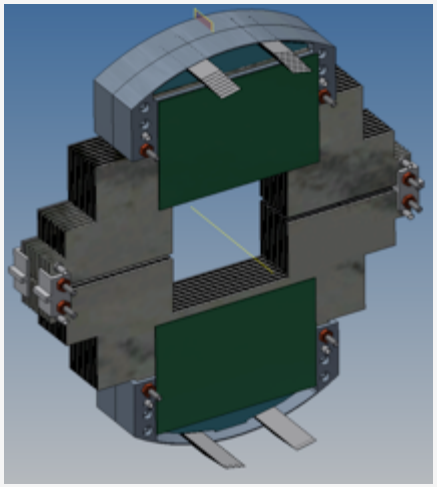
1. Repeat all steps as for the MPC South

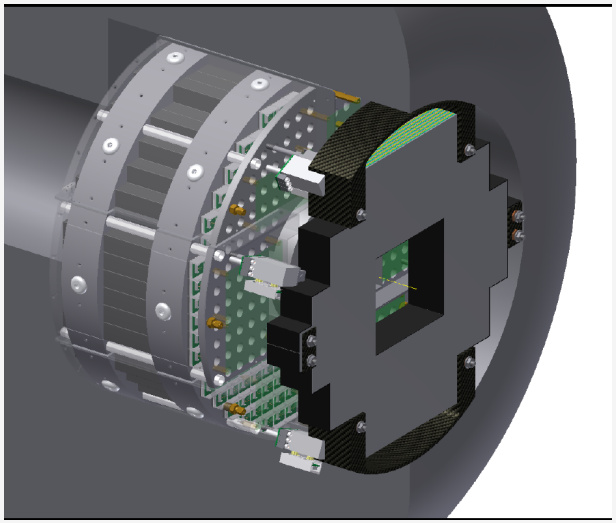
Closeout

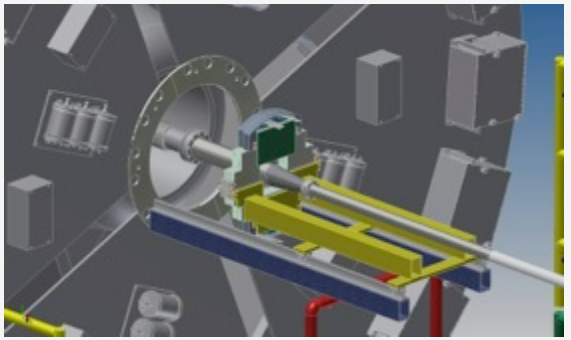
After removal is complete, document and record any lessons learned in this initial installation. Sign and close out the MPC-Ex work permit.

PHENIX

MPC-Ex Removal & Repurposing Plan

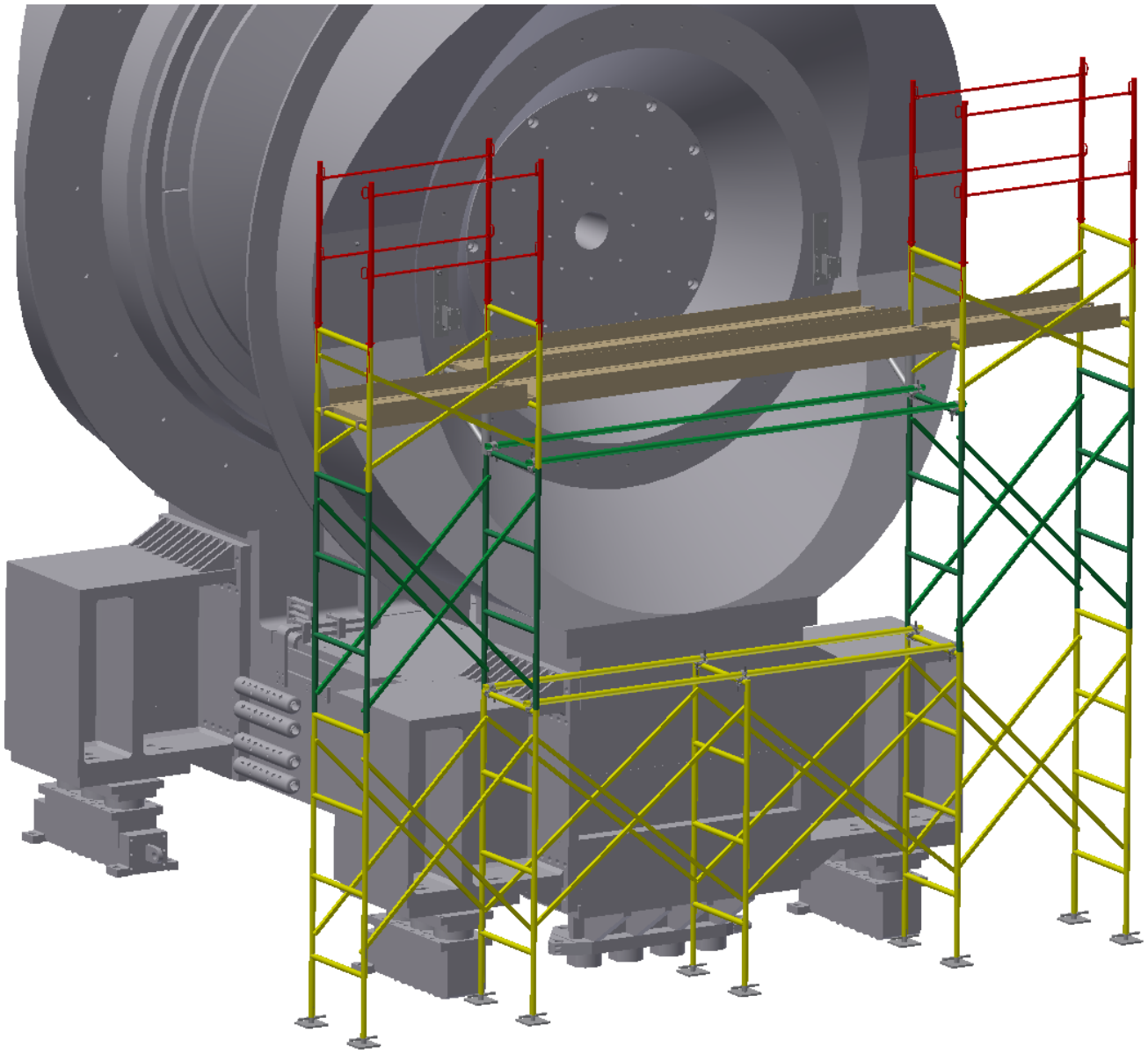






June - November, 2016

Don Lynch

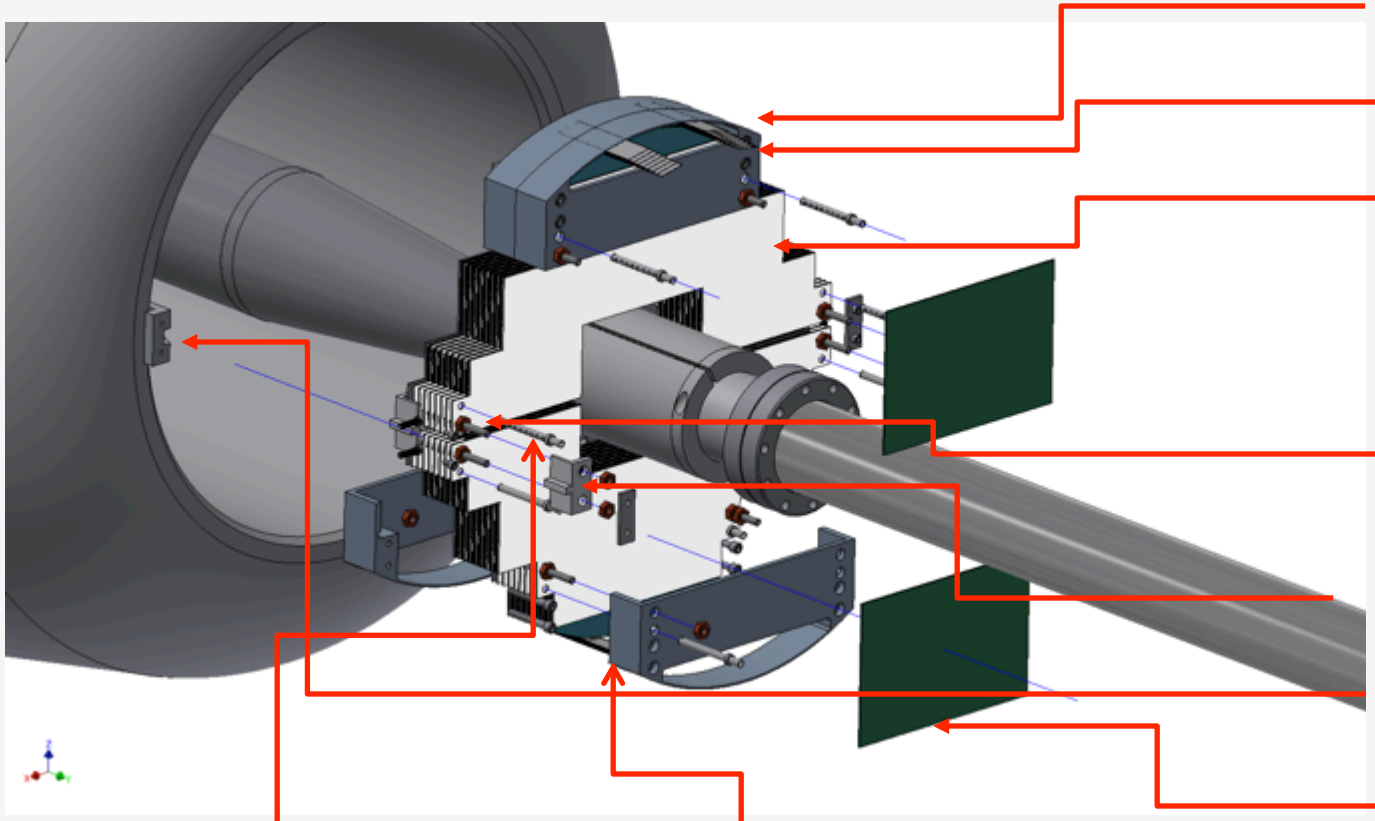


SAFWAY Scaffolding arrangement for upper access. Ladder and MMN not shown for clarity.

Configuration required for space between CM and MMS is similar.

PHENIX

MPC-Ex Exploded view



Upper covers

Signal Cable pigtails

8 layers of tungsten & detector electronics backed by Delrin cover (top and bottom halves)

Threaded rods and spacers

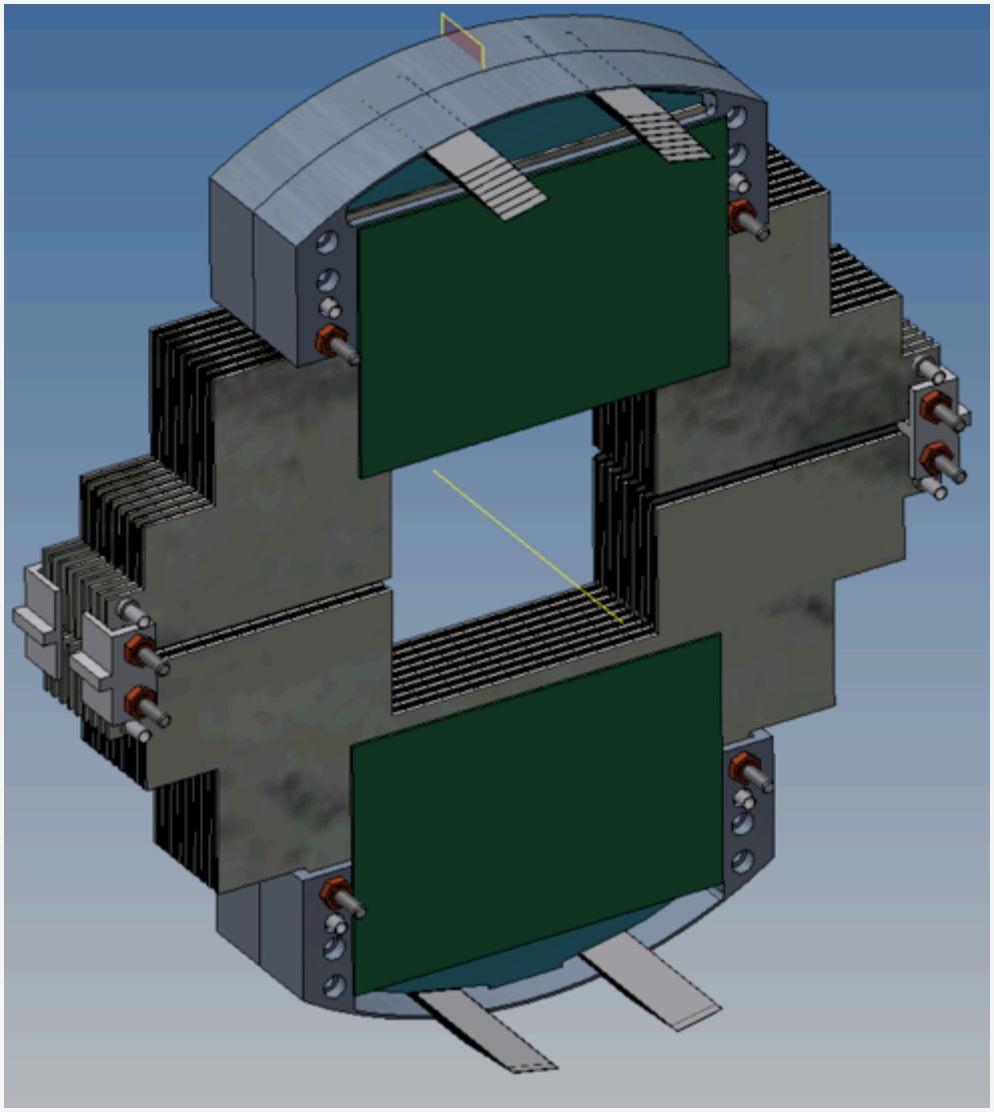
Mounting tabs

Mounting clips

LV distribution boards

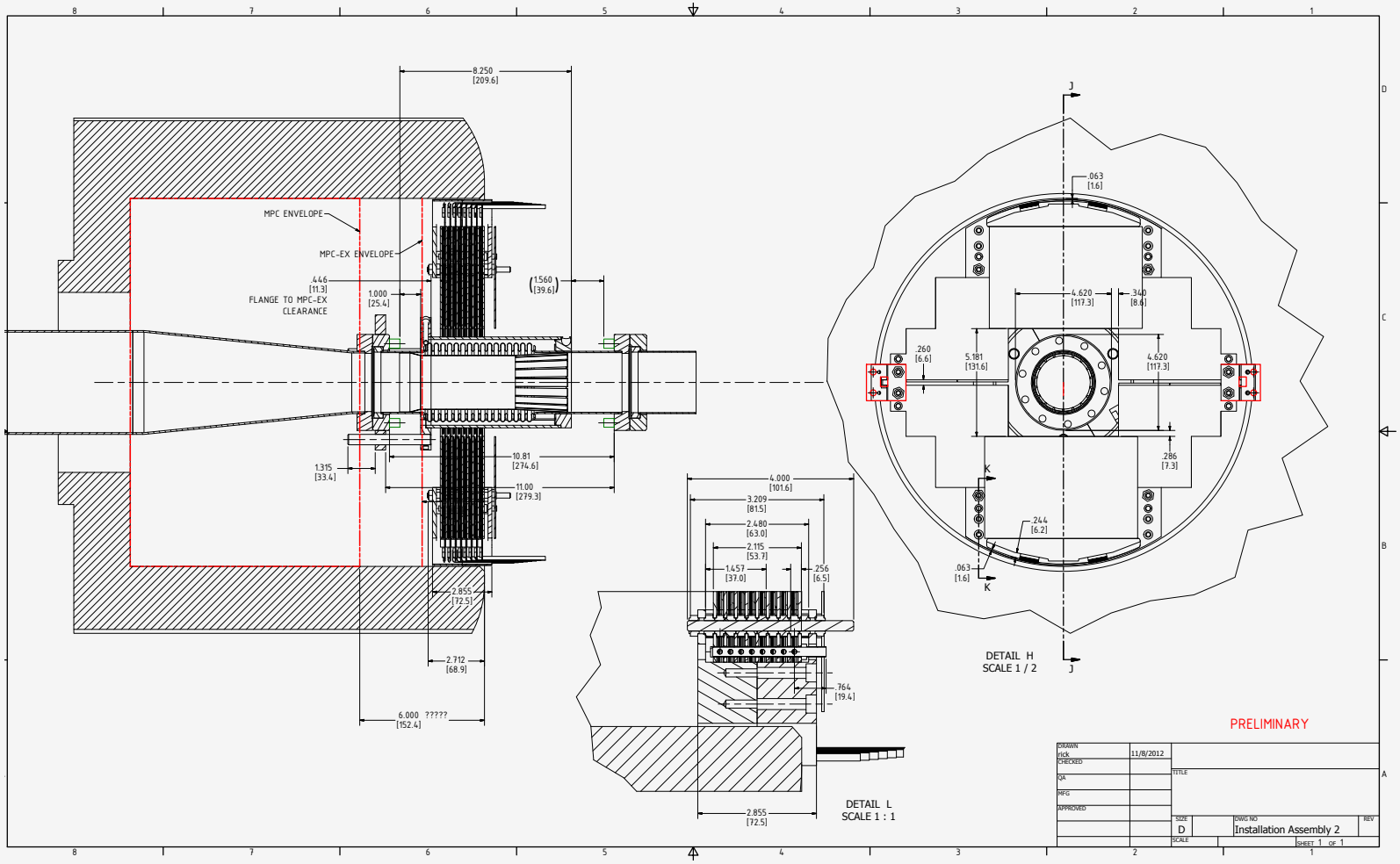
Lower covers

Cooling air manifolds

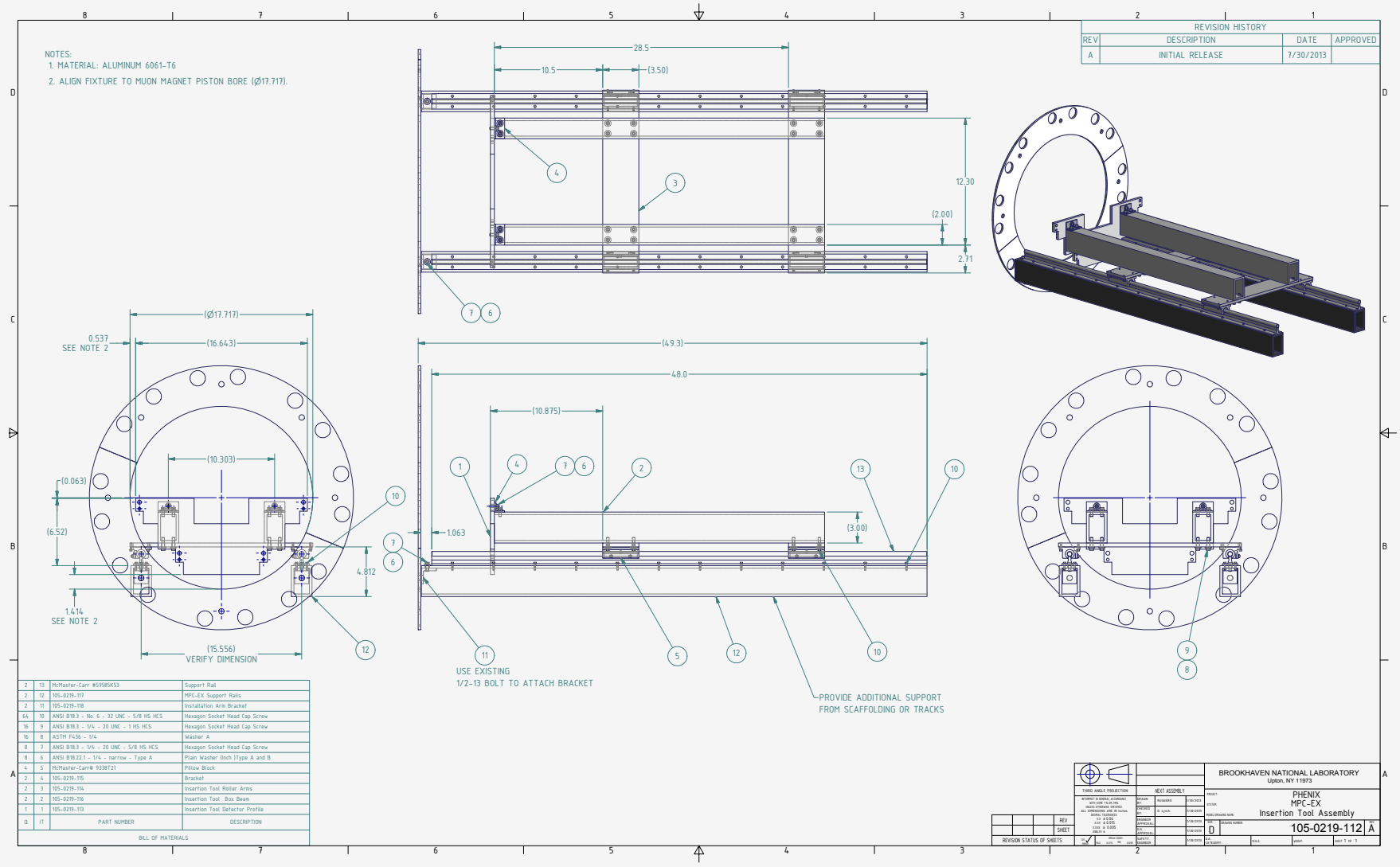


MPC-Ex Full Model

Run 14 Partial installation will include $\frac{1}{4}$ of the electronics and all of the tungsten for the south detector. Edge closures not shown.



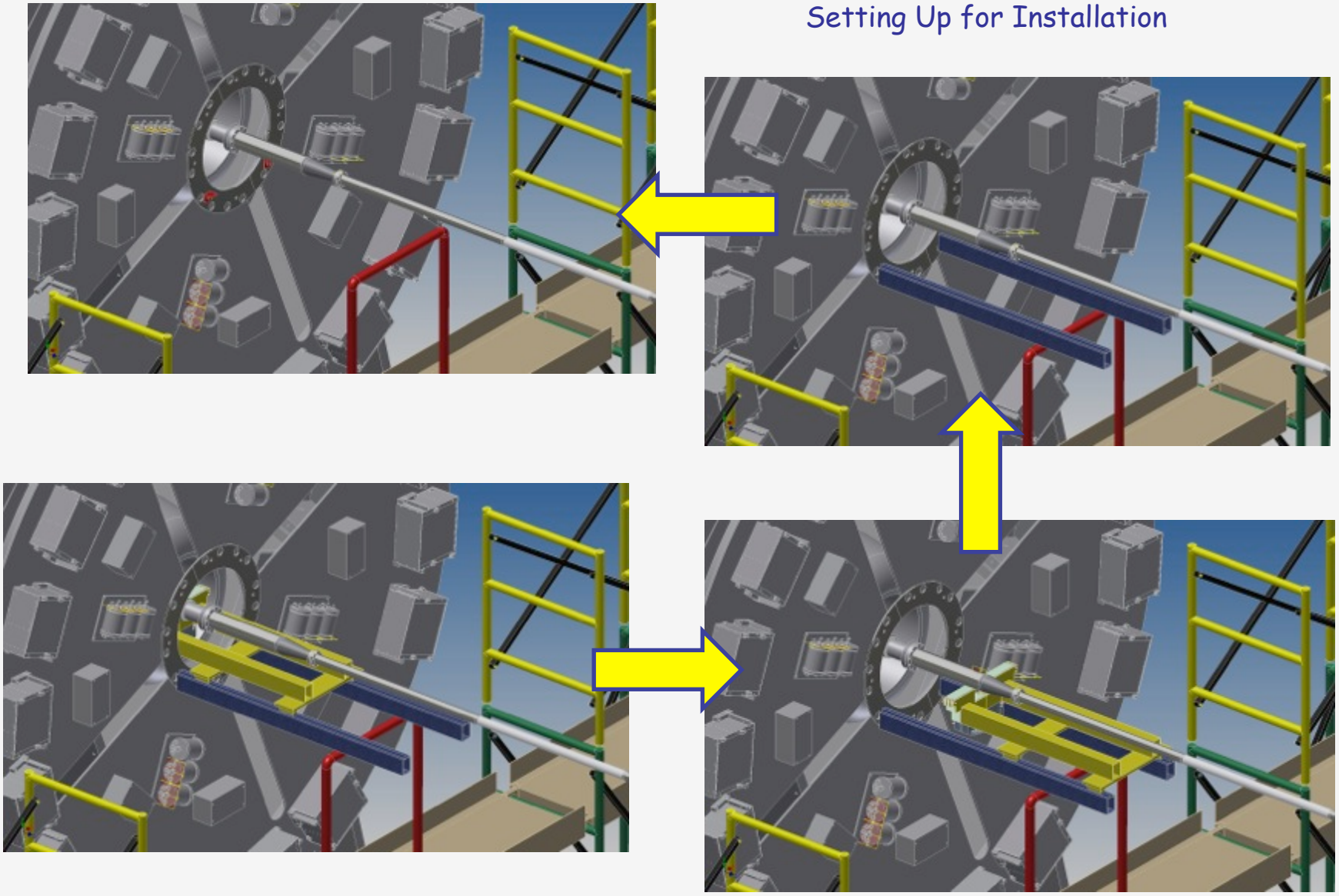
Installed Layout

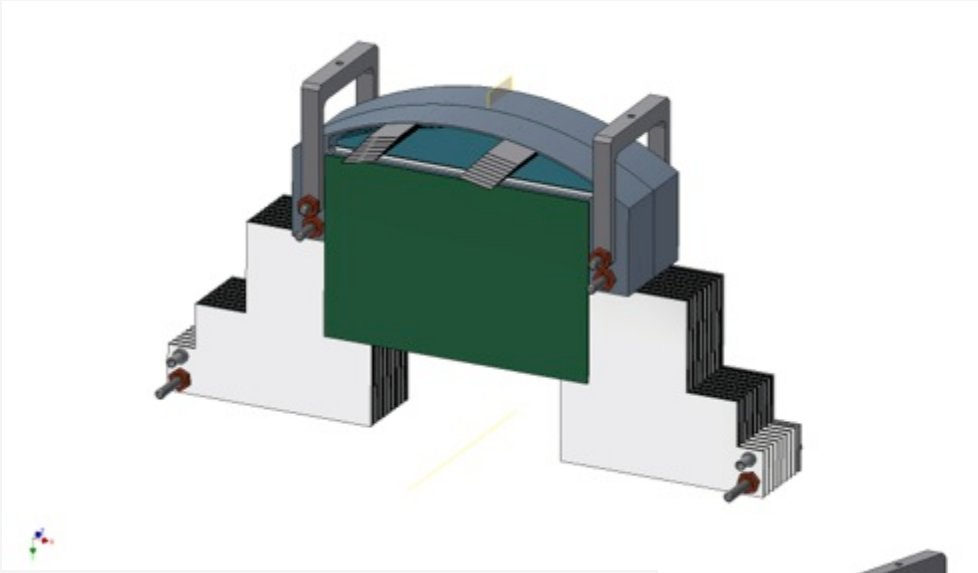


MPC-Ex Insertion/Installation Tool

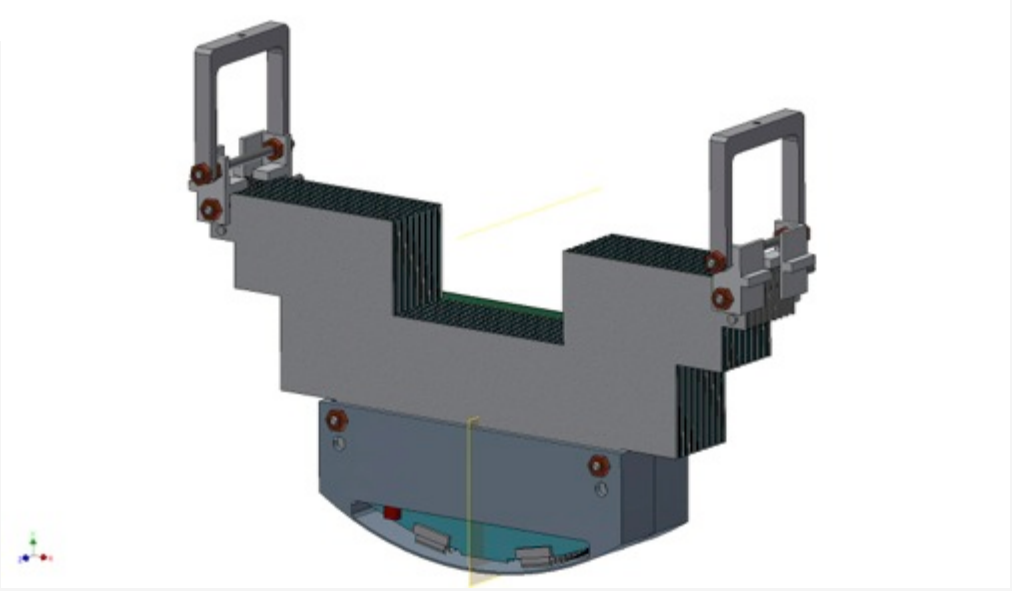
PHENIX

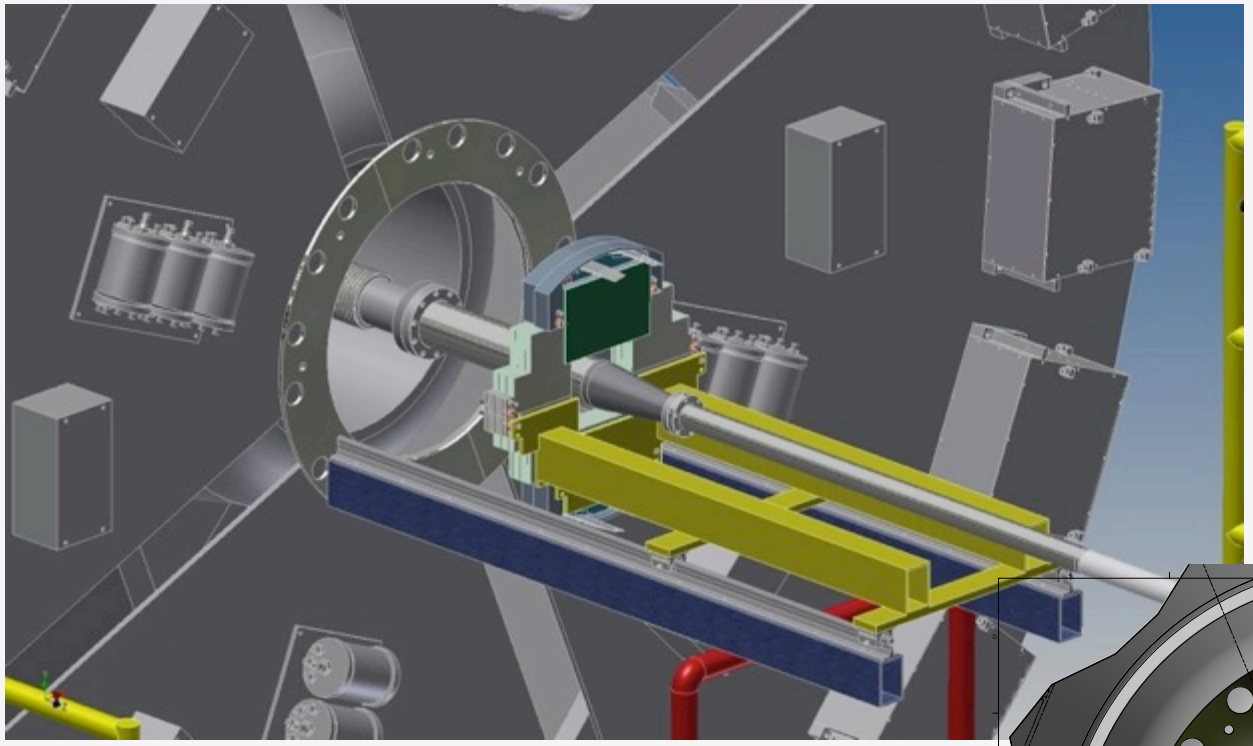
Setting Up for Installation

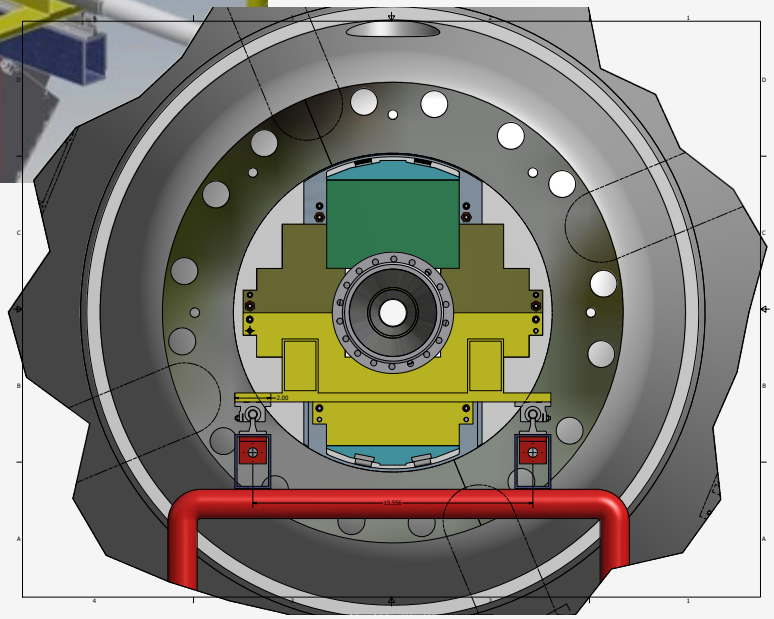




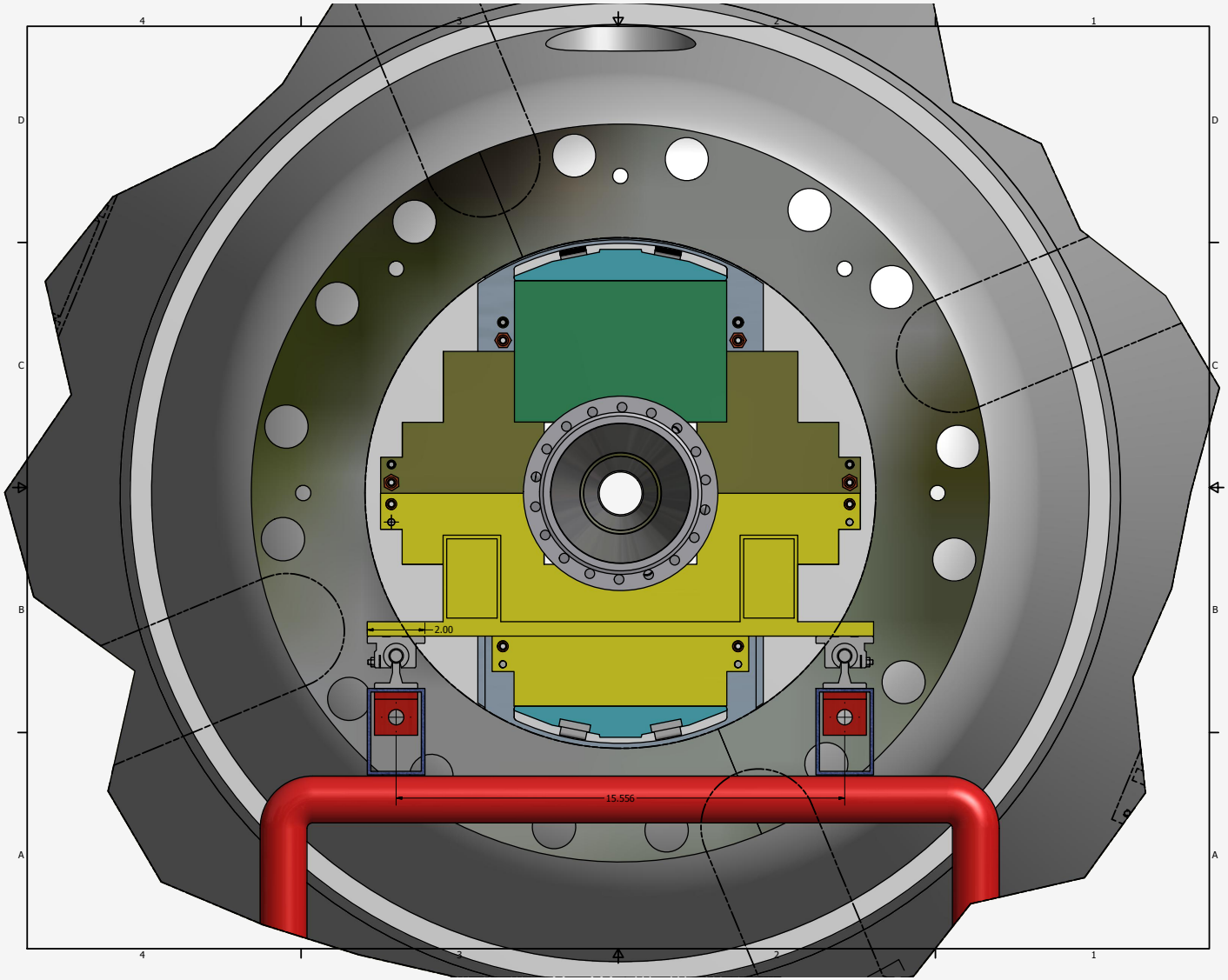
Upper and lower MPC-Ex halves with lifting tools for positioniong halves around beampipe on insertion/lifting tool







MPC-Ex installed on insertion/ installation/removal tool after removal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Human Resources Division

BROOKHAVEN
NATIONAL LABORATORY

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tucker@bnl.gov

managed by Brookhaven Science Associates
for the U.S. Department of Energy

date: July 1, 2014

to: E. O'Brien, P. Pizzo

from: Ernest L. Tucker

subject: Scaffolding in support of the PHENIX detector

The staff assigned to the PHENIX Experiment, are required to perform work on the detector. The work will require the installation of scaffolding within the detector as well as outside of it. The following is a summary of the agreement made between the IBEW and PHENIX regarding the installation and removal of the scaffolding in support of the project.

- A PHENIX technician and an IBEW carpenter will cooperate to erect, modify, disassemble and re-erect scaffolding in the station 1 north and south area of the PHENIX IR in close proximity to various PHENIX detector systems and the PHENIX Beryllium beam pipe system, inside the north and south magnets, and between the CM and the DC west detector.
- An IBEW carpenter will be present while PHENIX technician performs work and vice versa. The absence of a carpenter for breaks, lunch, and other short periods will not impede the work of the PHENIX technician as long as an IBEW carpenter is assigned to this project.
- The scaffolding will be modified to change platform elevation several times and will be moved from the North Station 1 to South Station 1 during the project. For each change an IBEW carpenter will be assigned to work with a PHENIX technician. If determined to be necessary, attachment of the scaffolding to the PHENIX decking will be performed by an IBEW carpenter.
- IBEW carpenter will fabricate all custom scaffold parts as needed.
- This agreement will be posted on Job site.

This agreement pertains to the particular job in question and is not in effect for future work nor does it apply to work on other detectors within RHIC. Future activities of this nature will have to be discussed and agreed upon by both parties before work can commence. Please distribute this information to all appropriate personnel.

Regards,

Ernest L. Tucker

Ernest L. Tucker
Labor Relations Business Partner

cc: D. Allshouse, D. Lynch, D. Tarrant

Brookhaven National Laboratory

PHENIX Station 1 Scaffolds

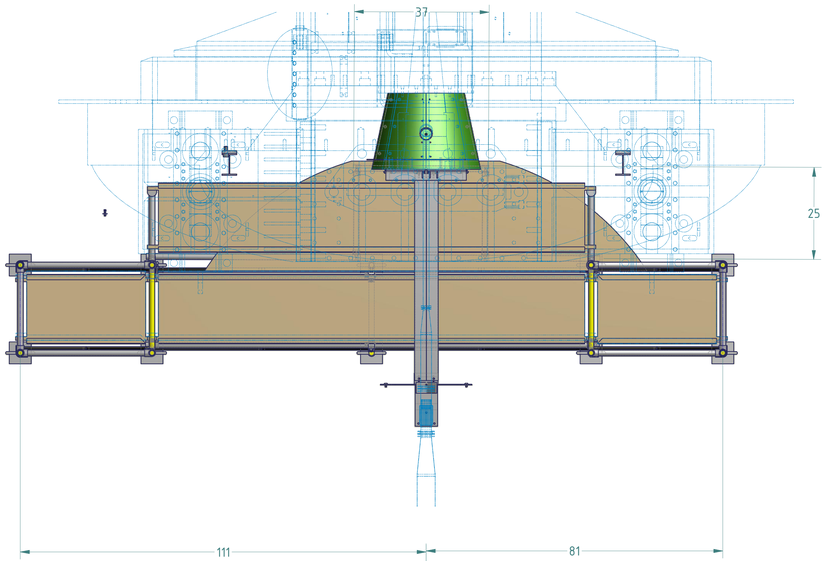
Scaffold Safety Checklist

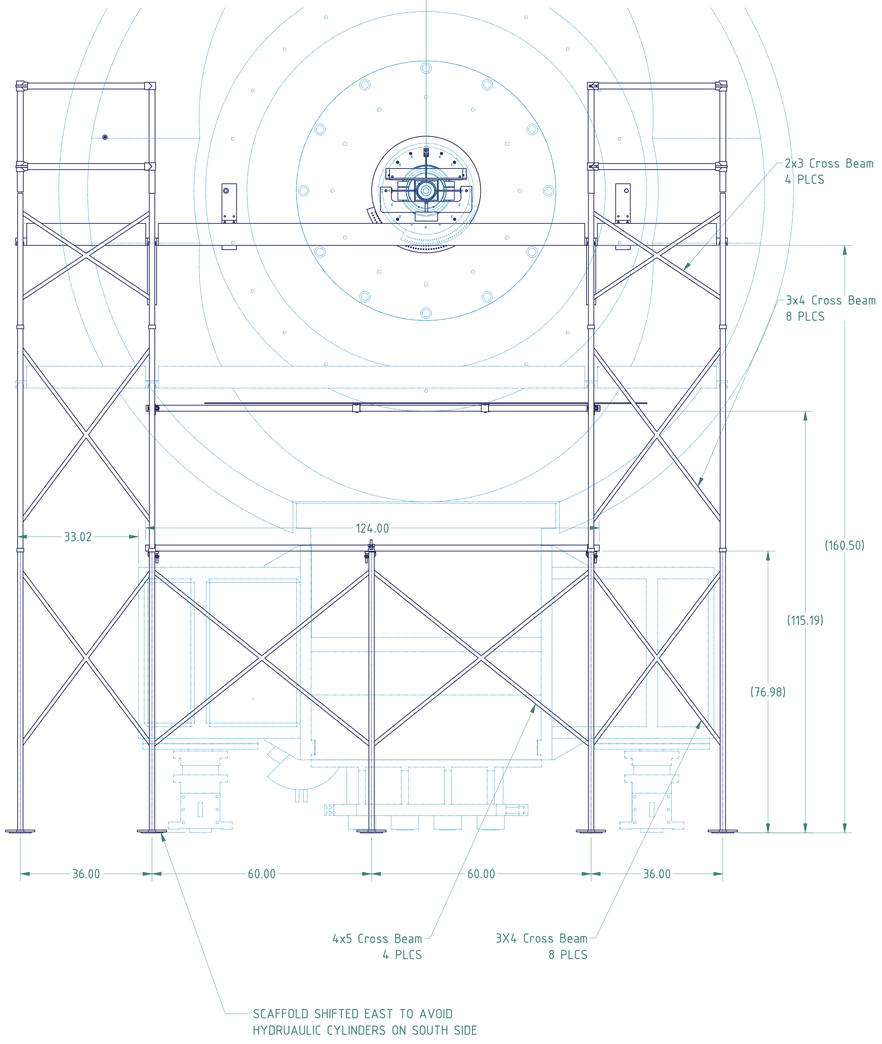
Project & Scaffold:	Job #	WO #:
Date of Inspection: Competent Person(s):		
Date Scaffold is complete:		

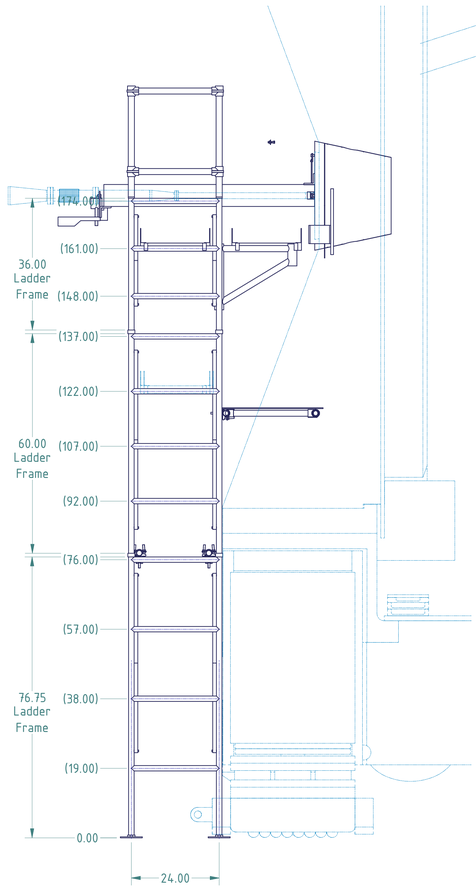
	YES	NO	COMMENTS
1. Have all personnel been trained in the safe use of the scaffold being used?			
2. Is a 'Competent Person' in charge of scaffold erection, dismantling, moving, or alteration?			
3. Have hazardous conditions been identified and guarded against, such as: Electric power lines?			
Be Beampipe protected?			
MuTr chambers covered?			
Magnets locked out?			
4. Is the scaffold erected in accordance with design drawings?			
5. Are scaffold components and planking in safe condition for use and is plank graded for scaffold use?			
6. Are base plates and/or screw jacks in firm and stable contact with the base surface?			
7. Is scaffold level and plumb?			
8. Are all scaffold legs braced and are all braces properly attached?			
9. Is the scaffold platform free of makeshift devices or ladders to increase the working height of the scaffold?			
10. Are guardrails installed properly, including toeboards?			
11. Are guardrails in place on all open sides and ends of scaffold platforms above 6' in height?			
12. Have all joints been secured with set screw and torqued to mfr. tolerances (screw heads to be marked to verify.			
13. Has scaffold been secured to building or structure at least every 30' in length and 26' in height?			
14. Have free standing towers been guyed or tied every 26' in height?			
15. Has scaffold been inspected and approved by C-A designated inspector(s)?			
16. Use space below and back of page for additional comments.			

NOTES:

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED
A			







PRELIMINARY

THIRD ANGLE PROJECTION	
INTERPRET IN GENERAL ACCORDANCE WITH ASME Y14.5M-1994. UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN MILLIMETERS DECIMALS: X.X ± 0.06 X.XX ± 0.02 X.XXX ± 0.005 ANGLES ± 0.5	
REVISION STATUS OF SHEETS	REV / SHEET
NEXT ASSEMBLY	
DRAWN BY:	RUGGIERO 10/4/2007
CHECKED BY:	D. LYNCH 10/4/2007
ENGINEER APPROVAL:	10/4/2007
QA APPROVAL:	10/4/2007
SAFETY ENGINEER:	10/4/2007

BROOKHAVEN NATIONAL LABORATORY
Upton, NY 11973

PROJECT: PHENIX
SYSTEM: System Engineering and Integration
MODEL/DRAWING NAME: Station 1 Safway Scaffold Assembly

SIZE: E | DRAWING NUMBER: 105-0500-092 | A

QA CATEGORY: | A3 | SCALE: 1/8 | WEIGHT: | SHEET 1 OF 1