BROOKHAVEN NATIONAL LABORATORY

Work Permit # DRL-2012-018 /SS-2012-208
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: 7/10/12012	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: 7/16/2012	Est. End Date: 10/15/2012
Brief Description of Work: Enter MMS, Erect work platforms, repair/upgrade MuTr & MuTrgr Sta 2 & 3 Electronics			
Building: 1008	Room: IR	Equipment: MuTr, MuTrgr, MMN	Service Provider MuTr/MuTrgr Experts, PHENIX Techs, CAD Techs

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

ESS&H 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
* Safety Health Rep. Review Required	☐ Haz, Rad, Bio Material Exceed DOE 151.1-C Levels - Contact OEM			☐ Other

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

FACILITY CONCERNS	☒ None	☐ Intermittent Energy Release		
☐ Access/Egress Limitations	☐ Electrical Noise	☐ Potential to Cause a False Alarm		☐ Vibrations
	☐ 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 appropriate	☐ Lab Coat	☒ Safety Glasses as appropriate
☐ Coveralls	☐ Ear Muffs	☐ Goggles	☐ Respirator*	☐ Safety Harness

☐ Disposable Clothing	☐ Face Shield	☐ Hard Hat	☐ Shoe Covers	☒ Safety Shoes	☐ 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 Confined Space 2A certification

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 Check O2 level prior to entry
☐ Liquid Effluent	☐ Passive Vapor Monitor	☐ Sorbent Tube/Filter Pump	

Training Requirements (List specific training requirements)

Confined Space, CA-Colider User, PHENIX Awareness, scaffold training, ladder training, working at heights

Based on analysis above, the Review Team determines the risk, complexity, and coordination ratings below:				**If using the permit when all hazard ratings are low, only the following need to sign: (Although allowed, there is no need to use back of form)**	
ESS&H Risk Level:	☒ Low	☐ Moderate	☐ High	WCC:	Date:
Complexity Level:	☒ Low	☐ Moderate	☐ High	Service Provider:	Date:
Work Coordination:	☐ Low	☒ Moderate	☐ High	Authorization to start	Date:
				(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 work plan and procedure	
Special Working Conditions Required (e.g., Industrial Hygiene hold points or other monitoring) None	
Notifications to operations and Operational Limits Requirements: None	
Post Work Testing, Notification or Documentation Required:	
Job Safety Analysis Required: ☐ Yes ☒ No	Review Done: ☒ in series ☐ team

Reviewed by: * Primary Reviewer signature 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 ESS&H 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 (PHENIX Escort)				
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 ESS&H 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:

Work plan Attachment **WP# DRL-2012-18/SS-2012-208**

MMS Entry During Shutdown for MuTr/MuTrigger South Troubleshooting

INTRODUCTION

Muon Tracker Detector (MuTr) and MuTrigger experts need to access the interior of the South Muon Magnet to install/troubleshoot/test noise reduction mechanically attached capacitors to MuTr detector subsystem electronics during the 2012maintenance summer shutdown period after the end of run 11 of the PHENIX experiment and to perform additional troubleshooting and repairs on MuTr and MuTrigger front end electronics (FEE's). During this period purge gas conditions (inert gases) for subsystems in the MMS will be maintained.

MMS MuTr TTS&R (Troubleshoot, Test and Repair)

The following operations will take place the PHENIX 2012 maintenance shutdow periods.

1. For the duration shutdown during which the MMS will be entered as described herein, all PHENIX magnets will be ramped down and locked out.

2. Prior to the first maintenance period for which entry into the MMS is required, The East vertical lampshade shall be removed by C-A technicians. No entry into the MMS shall be permitted until after C-A safety has been contacted to sample the internal atmosphere of the MMS. When C-A safety arrives to take the, an access ladder shall be erected to permit sampling and an O_2 content check of the MMS internal atmosphere shall. The O2 content shall then be sampled and recorded on a copy of the attached sheet. Each monitoring check shall have its own record sheet.

3. The C-A confined space safety expert shall determine from the tests whether it is safe to enter the MMN for the purposes stated herein. ***In no event shall anyone enter the MMS prior to approval of the C-A confined space monitoring expert.***

4. **During the entire maintenance period in which personnel may be inside the MMS, a 100 cfm blower shall direct external air into the MMS cavity.**

5. After clearance to enter has been approved, properly trained PHENIX technicians and BNL carpenter(s) shall sign the entry log sheet (attached) and may then enter and construct elevated work platforms as described in PHENIX document DRL-ECD-2012-002 rev D, for the purpose of accessing MuTr and MuTrigger FEE's and detector electronics at elevated areas within the South Muon Magnet (MNS). At any time when any personnel are inside of the MMS an additional watch person shall be stationed outside of the MMS and adjacent to the removed lampshade to monitor the well being of those engaged in work inside. The watch person shall have no other responsibilities during his watch and may not leave his post unless relieved by an equally qualified and dedicated watch person. All work platforms shall be reviewed, inspected and approved by appropriately qualified PHENIX engineering prior to permitting work to be performed on such platforms. At various times during the troubleshooting and repairs, adjustments and changes to the work platforms shall be made to better access different areas in the MMS. After each such adjustment, an appropriately qualified PHENIX engineer shall

review, inspect and approve such platform prior to releasing it for use. All inspections shall be documented on the attached MMS work platform inspection sheet.

Note: at all times the number of persons and the combined weight of persons and equipment shall be below the maximum allowable (2 persons and less than 600 lbs on each platform, 3 persons and less than 900 lbs on all platforms in the MMS). This is in accordance with the design calculations of DRL-ECD-2012-002 rev D.

6. After clearance work platforms have been erected, properly trained MuTr subsystem and MuTrigger FEE experts and/or properly trained PHENIX technicians shall sign the entry log sheet (attached) and may then enter and perform troubleshooting and operational checks. At any time when any personnel are inside of the MMS an additional watch person shall be stationed outside of the MMS and adjacent to the opened lampshade to monitor the well being of those engaged in work inside. The watch person shall have no other responsibilities during his watch and may not leave his post unless relieved by an equally qualified and dedicated watch person. All those inside the MMS and the watch person shall have current BNL confined safety training and shall comply with all requirements of the BNL Confined Space SBMS standards. As work progresses ***This work permit, the MMS entry log, platform inspection sheet(s) and the Confined Space Entry Certification Form shall be posted near the opened lampshade.***

7. During testing, HV to the MuTr detector panels may turned on and off to trouble shoot faults and test quality of the repair/test connections. Current/voltage limits on MuTr components are within allowable working limits per the PHENIX Awareness Procedure and/or properly shielded from personnel contact and do not require any additional permits.

7. After all work has been completed and no additional access to the interior MMS is required for the current maintenance shutdown period all equipment brought into the MMS shall be removed, work platforms dismantled, the MMS east vertical lampshade re-installed, and the MMS lockout removed.

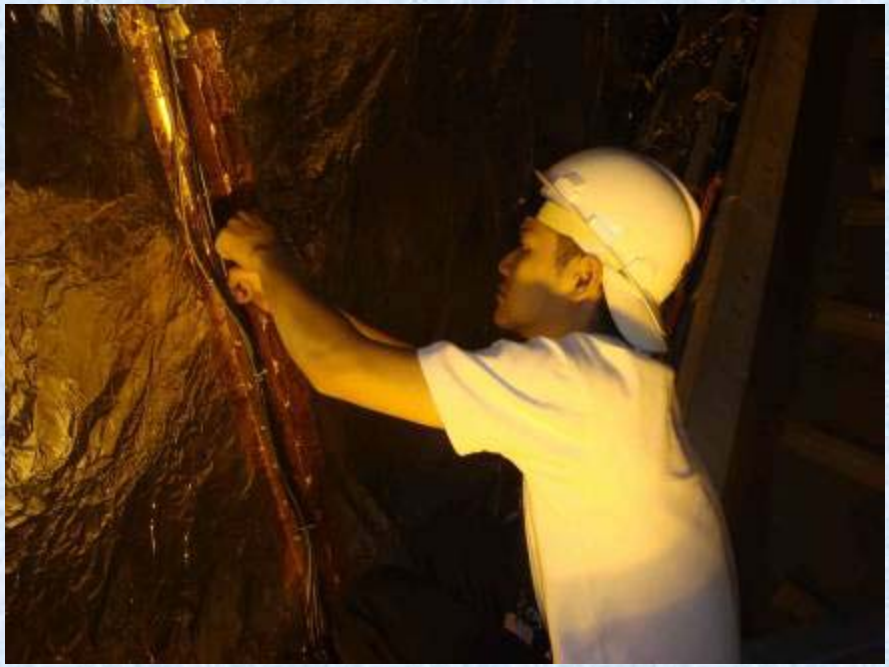
8. After all tasks covered by this work permit have been completed, all equipment brought into the MMS has been removed, the MMS east vertical lampshade re-installed and the MMS lockout removed, this work permit shall be closed and all relevant observations and comments concerning the work performed under this work permit shall be recorded. Should additional subsequent work in the MMS be required, a new work permit shall be generated.

MuTr Station 2 & 3 Re-Capacitation and Termination

Re-capacitation of MuTr stations 2 and 3 (inside MMS and MMN magnets) will be done using clamping and installation technique developed by MuTr experts during run 12 as was performed during 2011 shutdown. Method requires no soldering or gluing, requiring only mechanical clamps.

During 2011 summer shutdown only areas requiring no interior scaffolding or elevated work platforms were addressed. Elevated work in MMN and MMS will be performed during 2012 shutdown.

Station-3 Clamp Installation



- Anode card Inspection with mirror : < 5min/clamp.
- Anode clean up if necessary : < 15 min./clamp
- Clamp mount : ~ 5min./clamp
- Voltage readout : 5min./clamp
- HV test : 10min.
- Total : 25 ~ 40 min./clamp

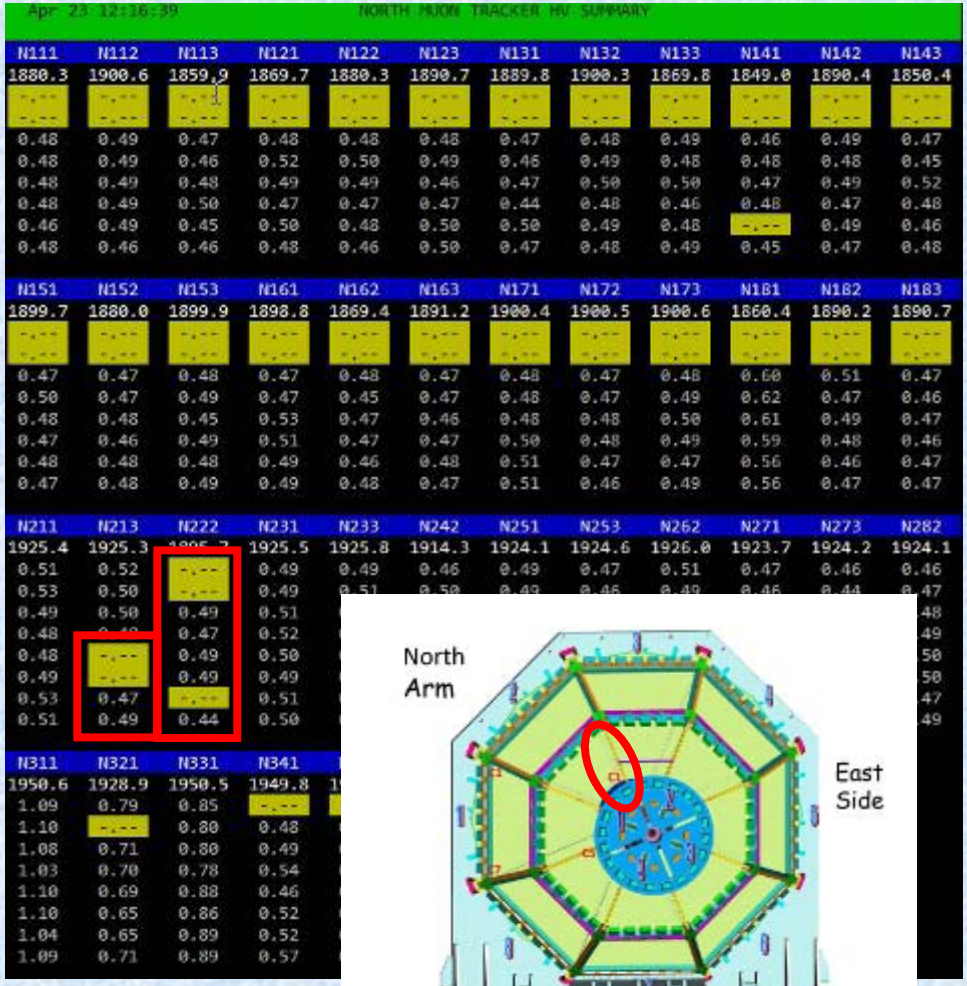
Single crew

North Sta-2 Oct-2 HV Repairs

5/12 HV channels in North Sta-2 Oct-2 bad

- located on interior of magnet at top
- pull dry air minifold
- investigate why these channels bad
- potentially remove and replace capacitors
- or isolate broken wires and disconnect from HV to recover other wires in same HV channel
- replace dry air manifold

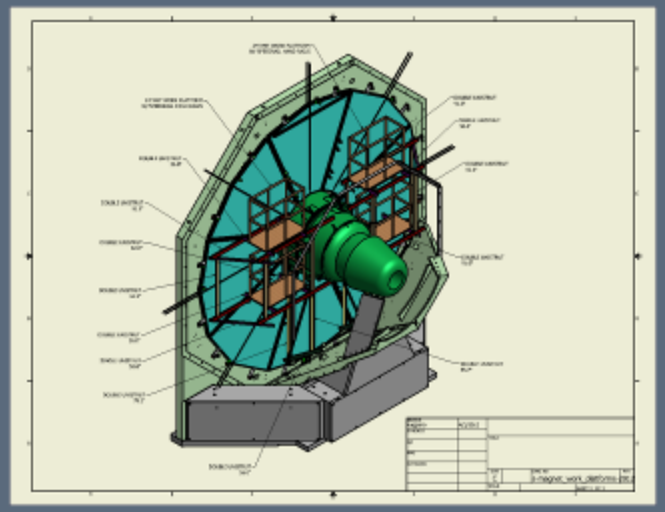
Also check HV clamp-terminators in North Sta-3 (3 HV channels are disabled); and in South

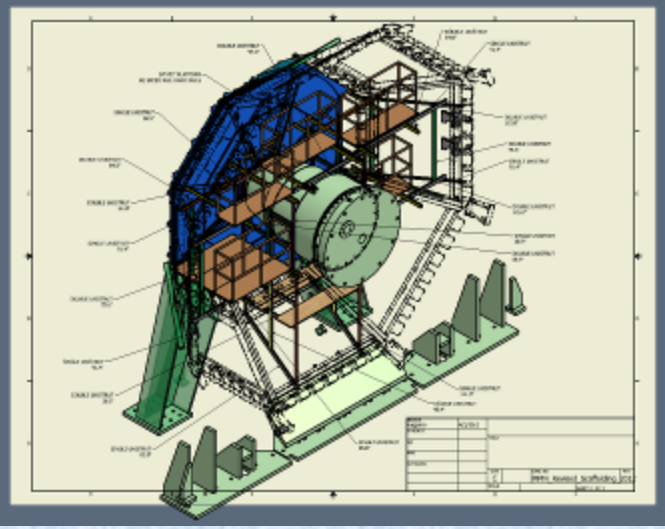


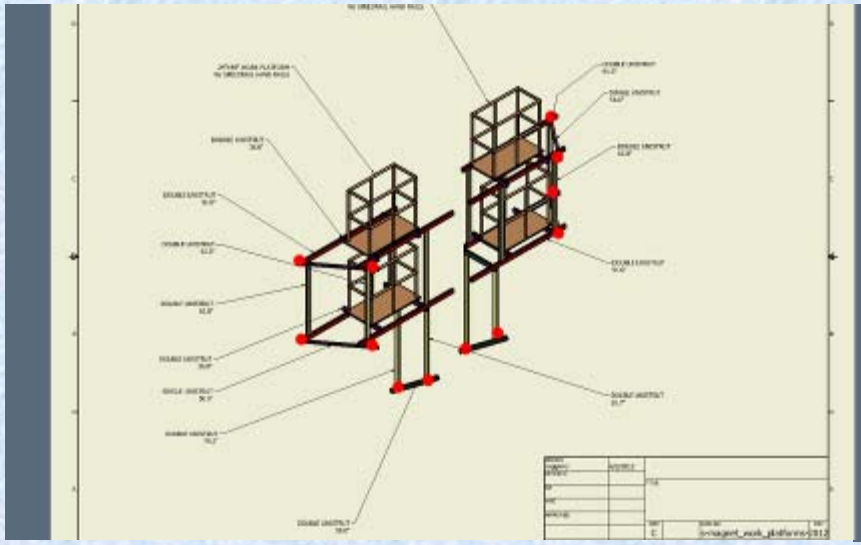
View from IR

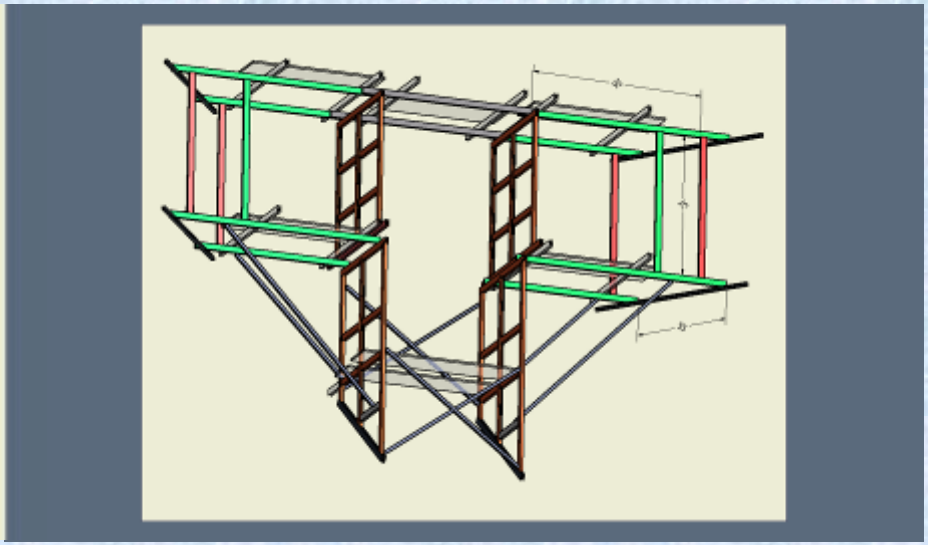
Clamp-on Terminator Installation on North & South Station-3

- Lower clamp-on terminators already installed for both north and south sta-3 (bottom 4 octants)
- with new work platforms that reaches all of sta-3; install remaining (upper) clamp-on terminators. Analyses submitted to CAD engineering.









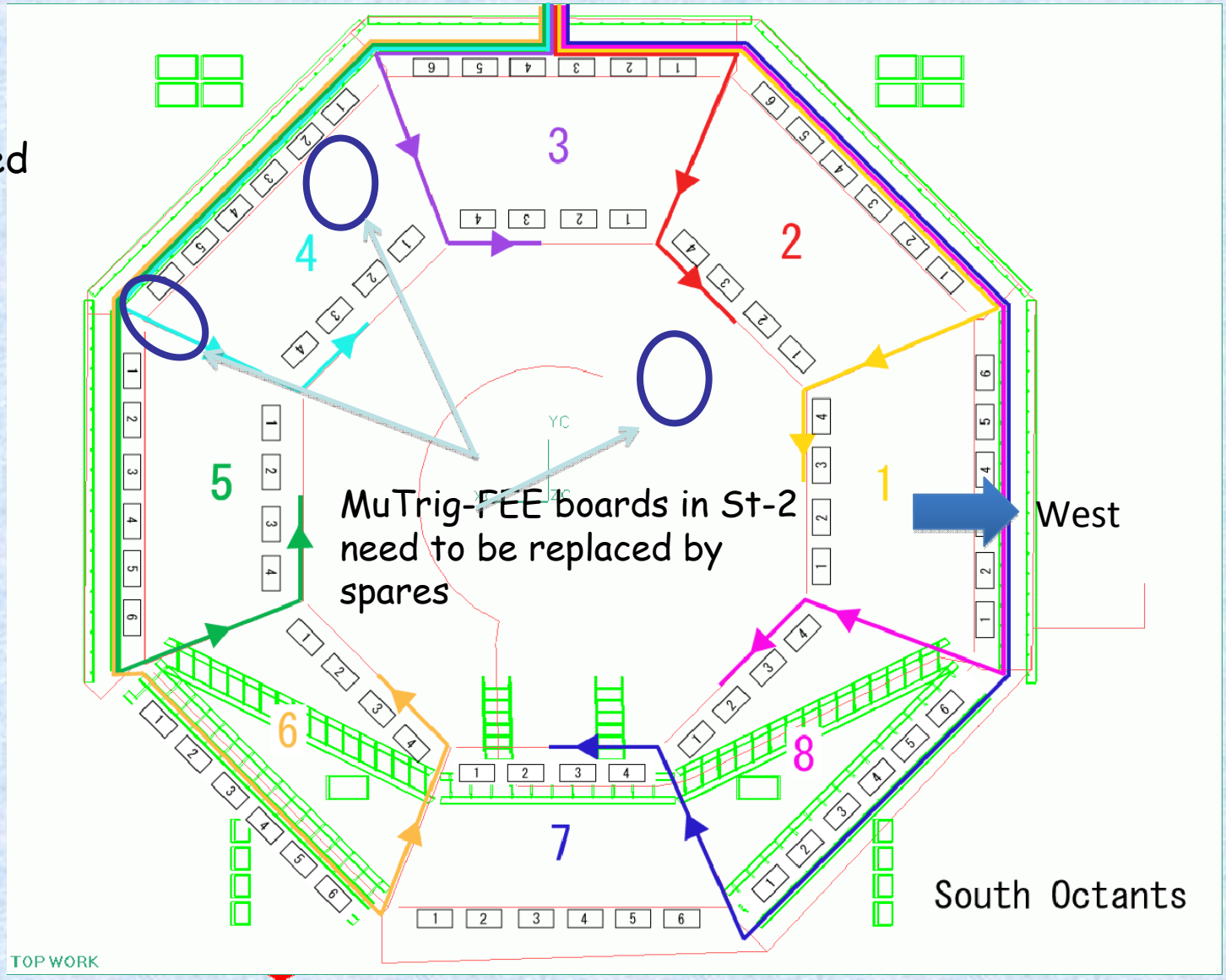
MMS Work Platforms

MMN Work Platforms

South Station-2

Location of electronics to be serviced

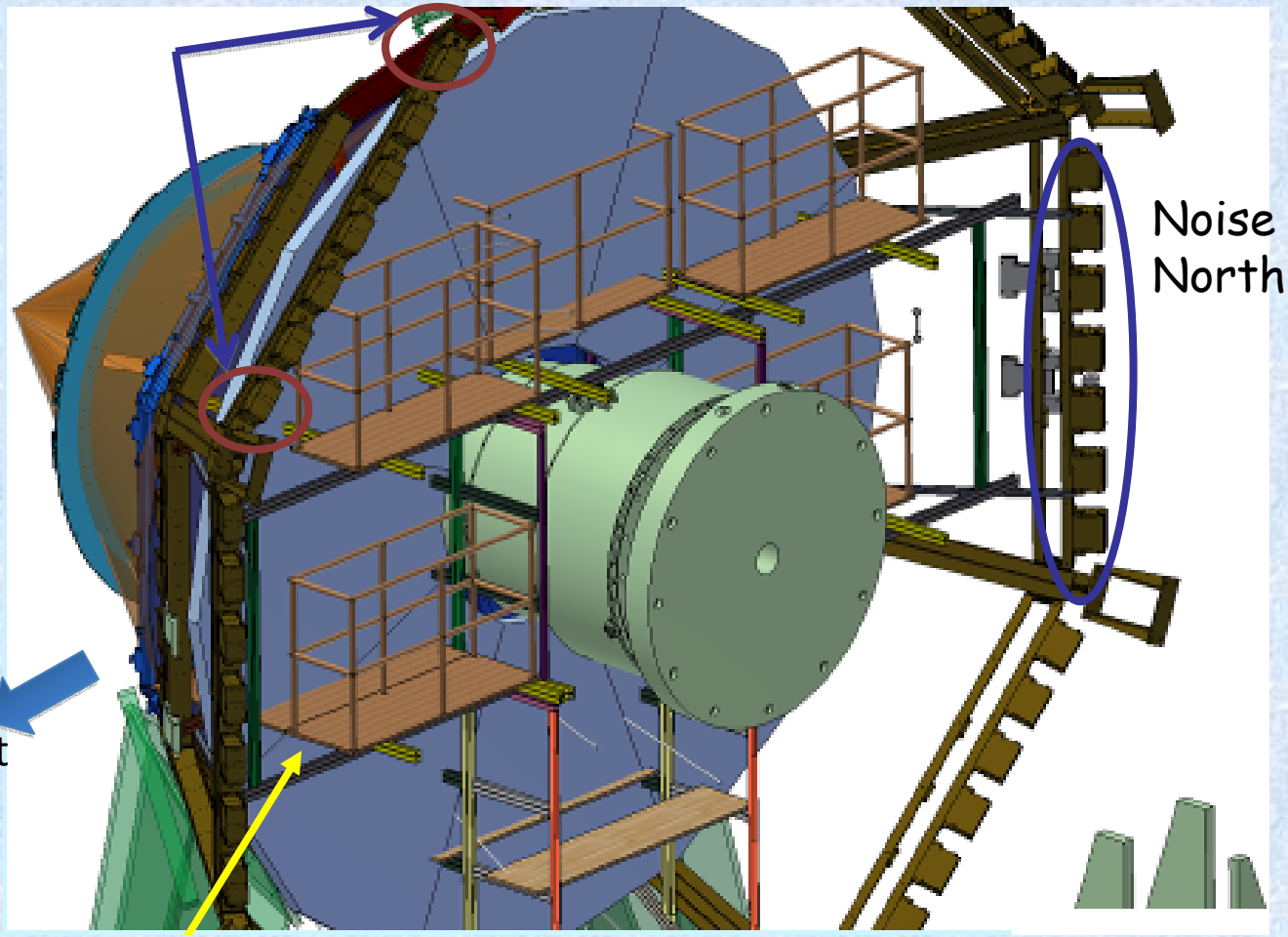
No boards in station-3 need to be served.



North Station-3

Octant-4
MuTrig Electronics boards need to be replaced by spare

No boards in station-2 need to be served.



2012 Shutdown Schedule

Prep for shutdown	2/1-6/25/2011
Define tasks and goals	
Analysis and design of fixtures, tools and procedures	
Fabricate/procure tools and fixtures	
Tests, mockups, prototypes	
Receive, fabricate, modify, finish installables	
Review and approval of parts, tools, fixtures and procedures	
Assembly and QA tests	
AH Crane Upgrade (variable speed & wireless remote)	
End of Run Party	6/22/2012
Run 12 Ends	6/25/2012
Shutdown Standard Tasks	6/25-7/20/2012
• Open wall, disassemble wall, Remove MuID Collars,	
• Move EC to AH, etc.	
VTX Strip-pixel post run tests	6/25-6/30/2012
FVTX post run tests	7/1-7/8/2012
Disassemble VTX/FVTX services	7/9-7/27/2012
July 4th Holiday	7/4/2012
Open Station 1 North, remove MPC North for repairs	7/9-13/2012
RPC1 North Cooling Upgrade	7/9-13/2012
Temporary power patch for IR and AH lights and cranes	7/16-7/20
AH electrical power panel upgrades	7/16-9/15
Remove VTX/FVTX and transport to Chemistry Lab	7/30/2012
Remove MMS & MMN vertical East lampshades	7/23-7/27/2012
Summer Sunday (8/5) Prep and teardown	8/1-8/7/2012
Summer Sunday (RHIC)	8/5/12

2012 Shutdown Schedule (Continued)

MuTr South Station 1 work	
Install access (Sta. 1work platforms)	7/30-8/3/2012
Disconnect Cables, hoses etc, ID/label all	8/6-8/10/2012
Remove FEE plates and chambers	8/13-8/17/2012
Station 2 Terminators and manifold upgrade through access opened by station 1 removal	8/20/-8/31/2012
MPC South repairs	8/20-9/15/2012
RPC 1 South cooling upgrade	8/20-9/15/2012
Labor Day Holiday	9/3/2012
MuTr South Station 1 work (Cont'd)	
Clean/install new MuTr Sta. 1 chamber parts and upgrades (concurrent At RPC Factory)	8/20/-9/7/2012
Re-install chambers and FEE plates	9/10-9/14/2012
Re-cable, re-hose and test	9/10-9/28/2012
re-capacitation and air manifold upgrades	
Station 3 North and South (upper half)	7/23-9/30/2012
Repair upgrade, reassemble VTX/FVTX	7/23-10/5/2012
Test, survey (at Chemistry and IR) and re-install VTX/FVTX	10/8-11/9/2012
Substation breaker upgrade/test (CAD)	8/20-9/30
AH utility power distribution upgrade	8/20-9/30
DC West maintenance (replace window)	9/15-10/15
RPC stations 1 and 3, north and south maintenance	As required
Other detector maintenance as required	As required
Infrastructure maintenance as required	As required
TBD prototype tasks	As required
Open Station 1 North, re-install MPC North	10/16-10/26/2012
RPC1 North Cooling upgrade (if not completed earlier)	10/16-10/26/2012

2012 Shutdown Schedule (Continued)

Veterans Day Holiday	11/12/201212
Pre-run commissioning and prep for run 13	11/1-12/31/2012
Prep for EC roll in	11/12-11/16/2012
Roll in EC	11/19-11/21/2012
Thanksgiving Holidays	11/22-23/2012
Prep IR for run	11/26-12/3/2010
Pink/Blue/White sheets	12/3-12/21/201
Christmas Holidays	12/24-25/2012
Start run 13	1/1/2013

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BROOKHAVEN NATIONAL LABORATORY

CONFINED SPACE ENTRY CERTIFICATION

Location Building 1008, IR, Muon Magnet North (MMN)	Date
Department PO	Division PHENIX
Building 1008	Area/Location/Room: IR, MMN
Supervisor/Designee Don Lynch/J. Carter Biggs	Life # 20146/15639

PRE-ENTRY QUESTIONS *For each item, check "yes" or "no": If no, consult Supervisor*	YES	NO
Is entry essential to perform work?	□	□
Have all personnel been trained in confined space entry?	□	□
Are conditions safe to remove utility-hole cover?	□	□
Has opening been guarded?	□	□
Is monitoring equipment calibrated?	□	□
Has monitoring been performed and recorded below?	□	□
Is GFCI used, if outside or in wet conditions?	□	□
Is ventilation blown into bottom of space? (If required)	□	□
Are personnel instructed to evacuate upon hazard detection?	□	□
Have all workers reviewed these entry requirements?	□	□
Radiation: If present, RWP may be required – review work with ESH Coordinator and RCD personnel. Evaluate hazards and controls.	□ **Reviewed**	□

SPACE CLASSIFICATION QUESTIONS For each item, check box only if "yes"	Class 2A	Class 2B	Class 2C
Engulfment Hazard Present			□
Entrapment Hazard Present			□
Electrical Systems:			
• Deenergized	**X**		
• Energized and Working Hot			□
• Energized, but Guarded or not Working Hot	□		
Mechanical Systems:	n/a		
• Deenergized	□		
• Energized and Working Hot			□
• Energized but Guarded or not Working Hot	□		
Other Energized Systems: (e.g., steam, sewage)	n/a		
• Deenergized	□		
• Energized and Working Hot			□
• Energized but Guarded or not Working Hot	□		
Chemical Hazards inherent in space, based upon monitoring, but controllable by Ventilating - ***Monitor for O_2 prior to entry***	X	□	
Chemical Hazards inherent in space, based upon monitoring, but not controllable by ventilating	n/a		□
Chemical Sources, introduced into space? (e.g., welding fumes, solvents)	n/a		□
High Temperature/Pressure Hazard? (other than steam utility-holes)	n/a		□

- If ANY box in column 2C is checked, a Confined Space Permit **IS** required.
- If any box in column 2B is checked, and none in column 2C, a Confined Space Permit **IS NOT** required **BUT** continuous monitoring and ventilating ARE required.
- If only boxes in column 2A are checked, no additional requirements apply.

Classification evaluation

CLASSIFICATION			
CLASS: 2A	I have completed the front and back of this Confined Space Entry Certification form and classified this space. If the confined space is classified as a 2C, I will obtain a Confined Space entry permit. If the space is Class 2B, continuous monitoring and ventilation is required and will be documented on this form.		
	Supervisor/Designee:	Life #	Date:

BNL CONFINED SPACE ENTRY CERTIFICATION

Meter:	Serial #	Calibration Date:
Day of Use Sensor Check □ Yes □ No		
Tested By:		BNL#:

MONITORING RESULTS					
Tested By:		BNL Number:			
Date/ Time	Oxygen % (% O2)	Flammable Gas (% LEL)	Carbon Monoxide (CO ppm)	Hydrogen Sulfide (H2S ppm)	Other:
Pre-Entry Certification test					
Acceptable Reading	19.5 – 23.5 %	< 10 % of LEL	<25 ppm	<10 ppm	

Supplemental sampling record

CLASS 2B CONFINED SPACE ENTRY CERTIFICATION

For Class2B spaces, continuous monitoring is required.

MONITORING RESULTS					
Tested By:		BNL Number:			
Date/ Time	Oxygen % (% O2)	Flammable Gas (% LEL)	Carbon Monoxide (CO ppm)	Hydrogen Sulfide (H2S ppm)	Other:
Acceptable Reading	19.5 – 23.5 %	< 10 % of LEL	25 ppm	10 ppm	

Class 2B: Describe Method of Ventilation:

Muon Magnet Confined Space Entry Certification Sheet

The undersigned certify that they have taken the BNL Confined Space Training, BNL Course # ***HP-OSH-016****, within the last twenty four months, and understand the hazards involved in working in the south and north muon magnets (****MMS and MMN).***

DATE	SIGNATURE	LIFE/GUEST #

Brookhaven National Laboratory

PHENIX MMN, MMS and 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.			