BROOKHAVEN NATIONAL LABORATORY

Work Permit # _____
Work Order # _____
Job# _____ Activity# _____

1. Work requester fills out this section. ☐ **Standing Work Permit**

Requester: Don Lynch	Date: 06/20/2008	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: 04/14/08	Est. End Date: 10/20/08
Brief Description of Work: MuTr Capacitor removal & MuTrgr FEE installation			
Building: 1008	Room: IR	Equipment: MuTrgr FEE's & MuTr chambers	Service Provider: PHENIX technicians and MuTrgr FEE & Mu Tr Experts

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 ☐ Other

☐ Special nuclear materials involved, notify Isotope Special Materials Group ☐ Fissionable materials involved, notify Laboratory Criticality 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	
☐ Adding/Removing Walls or Roofs	☐ Critical Lift	☐ Fumes/Mist/Dust*	☐ Magnetic Fields*	☐ Pressurized Systems
☐ Asbestos*	☐ Cryogenic	☐ Heat/Cold Stress	☐ Nanomaterials/particles*	☐ Railroad Work
☐ Beryllium*	☐ Electrical	☐ Hydraulic	☐ Noise*	☐ Rigging
☐ 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
* Industrial Hygiene (IH) Review Required				☐ 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**		
☐ Access/Egress Limitations	☐ Electrical Noise	☐ Potential to Cause a False Alarm	☐ Vibrations
	☐ Impacts Facility Use Agreement	☐ Temperature Change	☐ Other
☐ Configuration Control	☐ 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")	

Personal Protective Equipment

☐ None	☐ Ear Plugs	☐ Gloves	☐ Lab Coat	☒ Safety Glasses	
☐ Coveralls	☐ Ear Muffs	☐ Goggles	☐ Respirator*	☐ Safety Harness	
☐ Disposable Clothing	☐ Face Shield	☒ Hard Hat	☒ Shoe Covers	☒ Safety Shoes	☐ 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 Check O2 level prio to entry
☐ Liquid Effluent	☐ Passive Vapor Monitor	☐ Sorbent Tube/Filter Pump	

Training Requirements (List specific training requirements)

Confined Space, CA-Colider User, PHENIX Awareness, Portable ladder, Fall protection, scaffold user, Lotto affected. Crane operator, Elec safety I, each as appropriate per attachment

Based on analysis above, the Walkdown 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:
				(Departmental Sup/WCC/Designee)	

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

Work Plan (procedures, timing, equipment, and personnel availability need to be addressed): See attached procedure and
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: No

Job Safety Analysis Required: ☐ Yes ☒ No	Walkdown Completed (Required): ☐ Yes

Reviewed by: Primary Reviewer signature means that the hazards and risks that could impact ESS&H have been identified, a Walkdown was completed and the hazards will be controlled according to BNL requirements.

Title	Name (print)	Signature	Life #	Date
Primary Reviewer				
ES&H Professional				
Building Manager				
Service Provider				
Work Control Coordinator	Don Lynch		20146	
Other				
	Review Done: ☐ in series	☐ team		

4. Job site personnel fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments).			
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 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 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 work area to work supervisor.) The WCC ensures that the change process to update drawings, placards, postings, procedures, etc. are initiated , if necessary.

Name:	Signature:	Life#:	Date:
Comments:			

Work plan Attachment **WP# _____**

MuTr Capacitor Removal and Muon Trigger FEE Upgrade Electronics Installation

(Note: This Work Permit has been revised to reflect changes to confined space training requirements. Existing requirements remain in effect until this revised permit is fully approved and issued byu the work control coordinator.)

INTRODUCTION

During the 2008 summer shutdown, PHENIX technicians, engineers and scientists will be performing corrective maintenance on the Muon Tracker (MuTr) detector chambers and simultaneously PHENIX personnel will be installing electronics (FEE's) and supporting components for the new Muon Trigger upgrade project. While each of these efforts will be undertaken primarily in and around the North Muon Magnet (MMN), some equivalent work will be done in and around the South Muon Magnet (MMS).

The work on the MMN requires access to elevated MMN interior areas and elevated areas in the station 1 vicinity. Access to these areas will require custom engineered scaffolding. To access the interior of the MMN, existing scaffolding designed specifically for the installation of the MuTr chambers and electronics will be utilized. For the station 1 area of the MMN new scaffolding has been designed and will be used.

For the interior MMN work, 4 MMN lampshades will be removed. Since all of the interior work will take place with those lampshades removed there is no danger of a oxygen deficient atmosphere and thus no internal O_2 sampling is required. In addition, as access to the upper scaffolding in the MMN can be made from the permanent stairs and access platforms on the north side of the MMN, confined space training is not required for persons whose work will be limited to the scaffold sections at and above the removed lampshade areas. Confined space training is still required for those working below that level who must access the interior of the MMN via the lower access hatch. (See photo diagram, attached)

Work on the MMS consists of only interior areas accessible without scaffolding and station 1, which is similar enough to station 1 north to allow the use of the same scaffolding. To access the interior of the MMS a single lampshade will be removed. Prior to access inside the MMS, C-A safety experts will test the interior atmosphere for adequate O_2 levels.

Procedures

I. Confined Space Certification

A. Entry into the MMN

All tasks described herein shall be performed during the summer 2008 shutdown. During this time all flammable gases shall have been purged from PHENIX detectors and in particular there shall be no gas flow to the Muon Magnet detectors except for dry air.

1. Prior to any Magnet entry, all PHENIX magnets will be ramped down and locked out.

2. Prior to entry into the MMN, C-A technicians shall remove the east and west vertical lampshades and the east and west upper bias lampshades, the MMN walkover platform and the west platform. Barriers shall be placed at the access points of the northeast tower. (Note: Planning for these tasks will be performed by C-A engineers and technicians as appropriate.)

3. As the MMN will be mostly open, atmospheric testing is not required for the MMN after the lampshades have been removed. No PHENIX personnel shall enter the MMN until the PHENIX liaison engineer determines that the efforts to remove the 4 lampshades have been completed and stowed and all overhead prep work has been concluded.

4. Entry into the MMN shall be by trained personnel only in accordance with the following:

a. All persons entering the MMN shall have C-A access, PHENIX Awareness, Electrical Safety 1, and (for the lower section only as described above) Confined Space training, and shall have read and understood all pages of this work permit
b. Confined Space rules shall apply, i.e. a watch person outside of the MMN must be present at all times, all who enter the confined space section of the MMN must sign the entry log prior to entry.
c. All persons working in the MMN during this time must have BNL scaffold use training
d. No more than 3 persons may work on any level inside the MMN at one time, no more than 9 persons total.
e. Personnel working on lower levels shall wear hardhats whenever other persons are working on levels above.
f. All other rules for working at PHENIX apply.

A. Entry into the MMS

All tasks described herein shall be performed during the summer 2008 shutdown. During this time all flammable gases shall have been purged from PHENIX detectors and in particular there shall be no gas flow to the Muon Magnet detectors except for dry air.

1. Prior to any Magnet entry, all PHENIX magnets will be ramped down and locked out.

2. Prior to entry into the MMS, C-A technicians shall remove the east vertical lampshade. This opening will then be the point of entry for accessing internal areas of the MMS. (Note: Planning for this task will be performed by C-A engineers and technicians as appropriate.)

3. After the lampshade has been removed an appropriate ladder will be provided by PHENIX technicians to access the MMS interior. Prior to any entry whatsoever, a C-A confined space expert shall perform an O_2 sampling test to determine the O_2 level in the MMS interior.

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

5. Entry into the MMS shall be by trained personnel only in accordance with the following:

a. All persons entering the MMS shall have C-A access, PHENIX Awareness, Electrical Safety 1, and Confined Space training and shall have read and understood this work permit
b. Confined Space rules shall apply, i.e. a watch person outside of the MMS must be present at all times, all who enter the confined space must sign the entry log each time they enter.
c. No more than 2 total persons may work anywhere inside the MMS at one time.
d. All other rules for working at PHENIX apply.

II. MMN Scaffolding

After the MMN has been cleared for entry appropriately trained and qualified personnel shall commence erecting the MMN scaffolding in accordance with the detailed construction drawings (attached).

The MMN scaffolding is constructed in 5 stages (as indicated in the design drawings). As each stage of construction is completed, erection of the scaffolding shall cease and the current status of the scaffolding shall be inspected by the PHENIX cognizant engineer and C-A scaffold inspection experts. For each coupling on the scaffolding, the locking screw shall be torqued in accordance with manufacturer's specification (these values are on the check off sheet). After the locking screw has been torqued it shall be marked by painting the screw head a readily identifiable color. (Note: typically red would be used, but after the scaffold has been used once the next time a different color [e.g. blue] should be used to assure that an untightened screw is not mislabeled.)

The scaffolding check sheet shall be filled out and each item signed off. Only after inspection is complete and approval granted can work on the scaffold continue.

(Note: the scaffolding is designed to be fully functional and useful in any of the 5 stages of construction. As each stage is completed and approved the scaffolding may then be used to perform tasks at that level as appropriate before constructing the next stage of the scaffolding. Once construction of the next stage has commenced, however, no work shall be performed on previous stages until that next stage is completed and approved.)

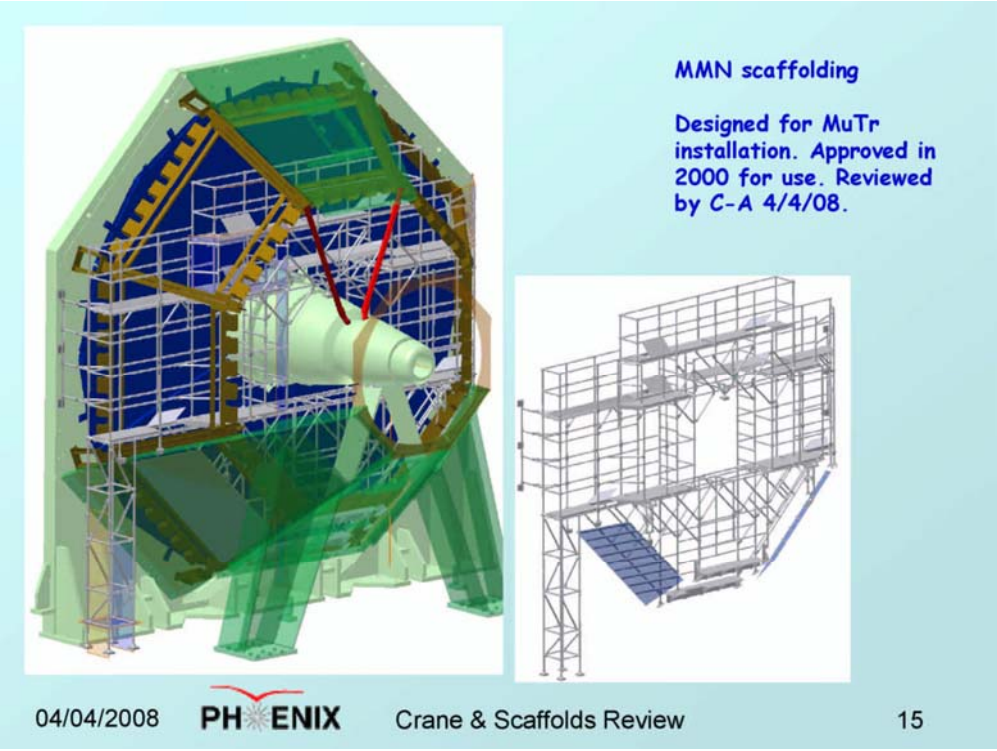

Figure 1: MMN Scaffold

No more than 3 persons may work on any level inside the MMN at one time, no more than 9 persons total.

III. Station 1 Scaffolding

Concurrently with the scaffolding efforts in the MMN, appropriately trained and qualified personnel shall commence erecting the Station 1 scaffolding in the Station 1 gap between the Central Magnet (CM) and the MMN in accordance with the detailed construction drawings (attached).

The station 1 scaffolding is constructed in 2 main levels (as indicated in the design drawings). After the first level of construction is completed, erection of the scaffolding shall cease and the current status of the scaffolding shall be inspected by the PHENIX cognizant engineer and C-A scaffold inspection experts. After the locking screw has been torqued it shall be marked by painting the screw head a readily identifiable color. (Note: typically red would be used, but after the scaffold has been used once the next time a different color [e.g. blue] should be used to assure that an untightened screw is not mislabeled.)

The scaffolding check sheet shall be filled out and each item signed off. Only after inspection is complete and approval granted can work on the scaffold continue.

(Note: the scaffolding is designed to be fully functional and useful as either a 1 or 2 level structure. As the first is completed and approved the scaffolding may then be used to perform tasks on level as appropriate before constructing the upper level of the

scaffolding. Once construction of the upper level has commenced, however, no work shall be performed on the lower until that upper level is completed and approved. In addition the Station 1 scaffolding is designed to be equally useful in the Station 1 north and station 1 south gaps due to the largely similar geometry involved. When the Station1 north tasks for both the MuTrigger FEE upgrade and the MuTr decapacitations have been completed the scaffolding shall be disassembled in the Station1 north gap and reassembled in the Station 1 South gap and all inspection and recording requirements followed for the north shall be repeated in the south.)

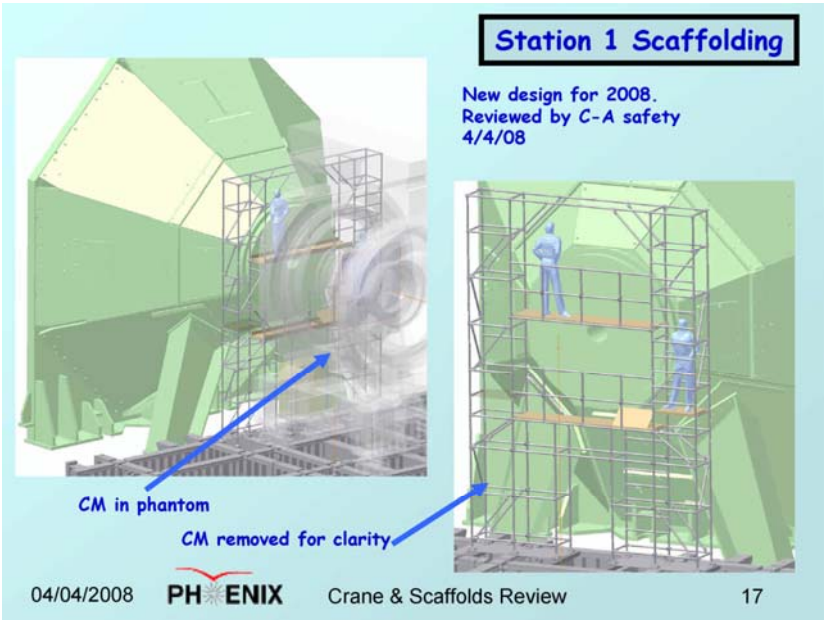

Figure 2: Station 1 Scaffold

No more than 2 persons may work at the same time on any level of the Station 1 scaffold. No more than 3 persons total may work on all levels at the same time.

MuTr N&S Decapacitations

1. After clearance to enter has been, properly trained MuTr experts and/or properly trained PHENIX technicians shall sign the entry log sheet (attached) and may then enter and perform installation and operational checks. (Note: work on Station 1 components does not require log entries, but all other requirements of this section do apply.)

2. During the task HV to the MuTr detector panels may turned on and off to trouble shoot faults and test quality of the installation. Current/voltage limits on MuTr chassis are within allowable working limits and/or properly shielded from personnel contact and do not require any additional permits.

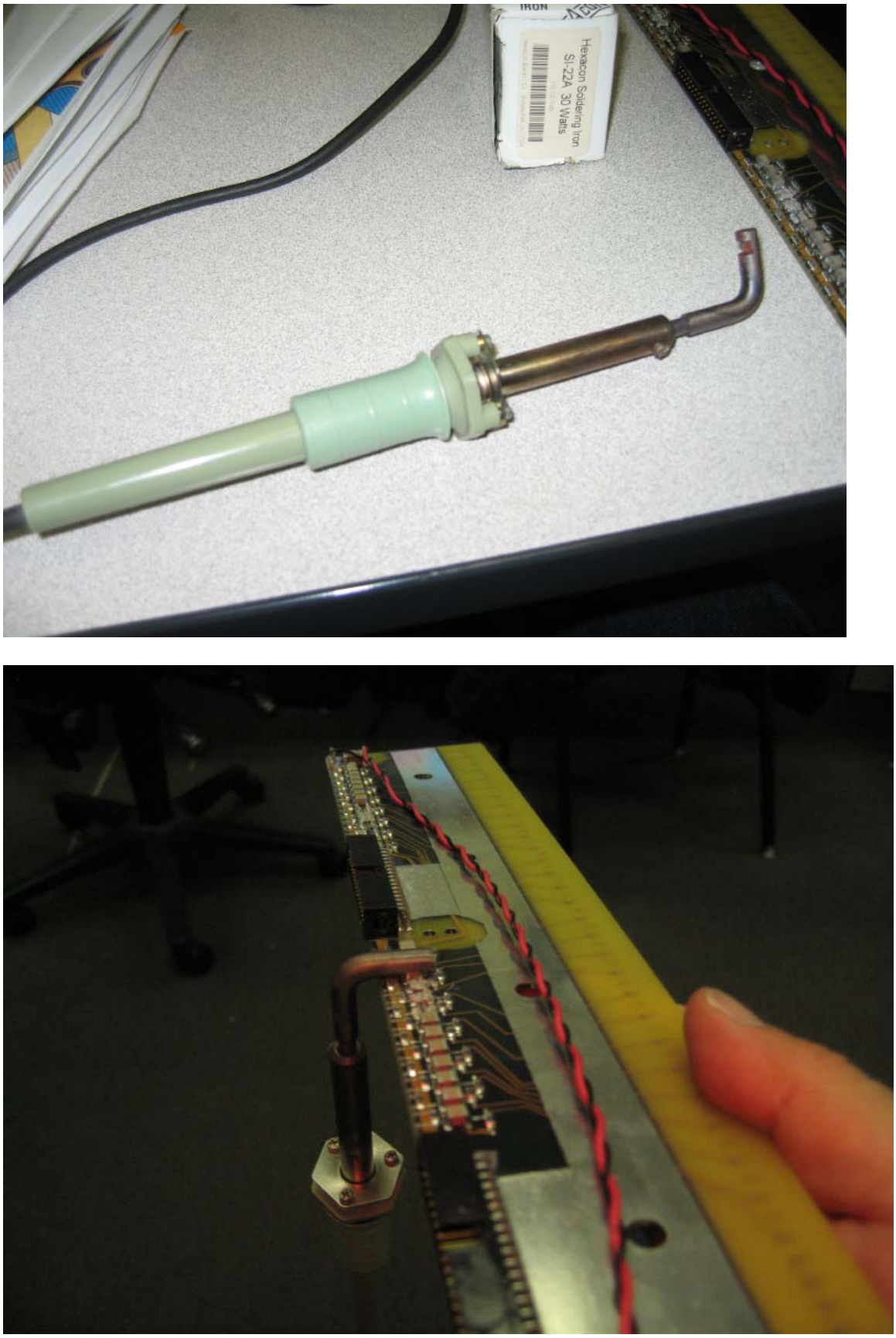

Figure 3: MuTr Capacitor removal tool

MuTrigger FEE Upgrade

1. After clearance to enter has been, properly trained MuTrigger FEE experts and/or properly trained PHENIX technicians shall sign the entry log sheet (attached) and may then enter and perform installation and operational checks of the new FEE upgrade modules. (Note: work on Station 1 components does not require log entries, but all other requirements of this section do apply.)

2. Installation may require the use of small hand tools, electrical and plumbing connectors and fittings. All items brought into the magnet shall be carefully accounted for such that extra fittings, trimmed wires, metal chips and any other excess parts or debris shall be carefully removed each and every time workers exit the Magnets. All tools brought into the workspace shall be removed and never left unattended.

3. During the task HV to the MuTr detector panels may turned on and off to trouble shoot faults and test quality of the installation. Current/voltage limits on MuTr chassis are within allowable working limits and/or properly shielded from personnel contact and do not require any additional permits.

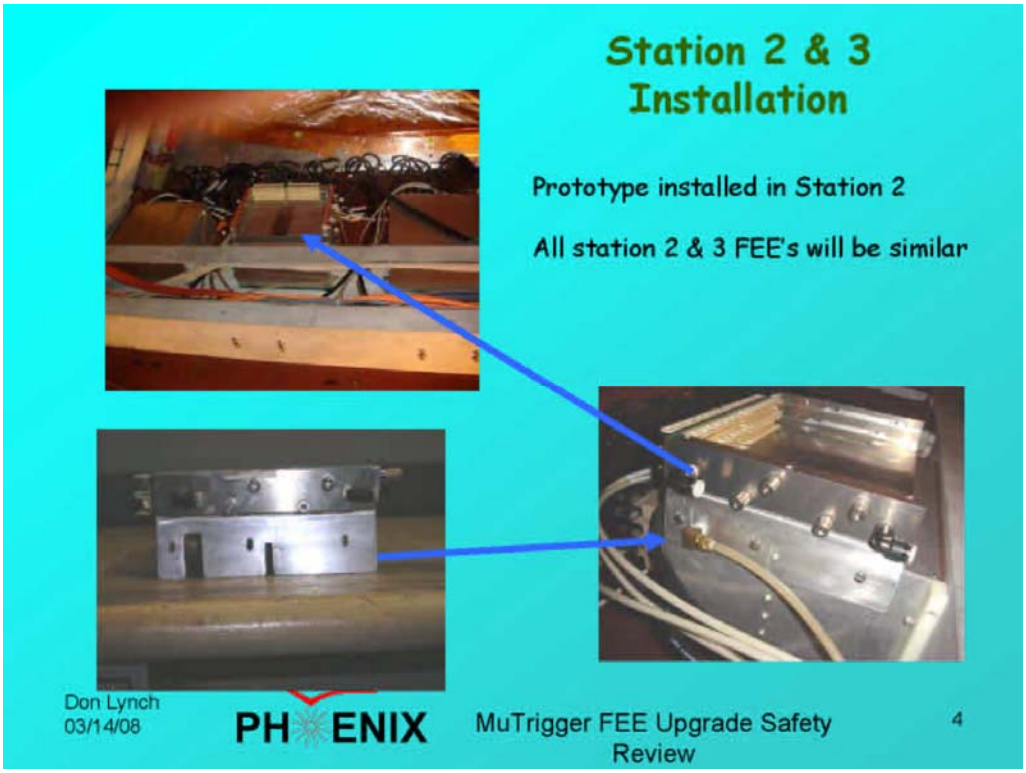

Figure 4: MuTrigger FEE Installation (Station 2&3)

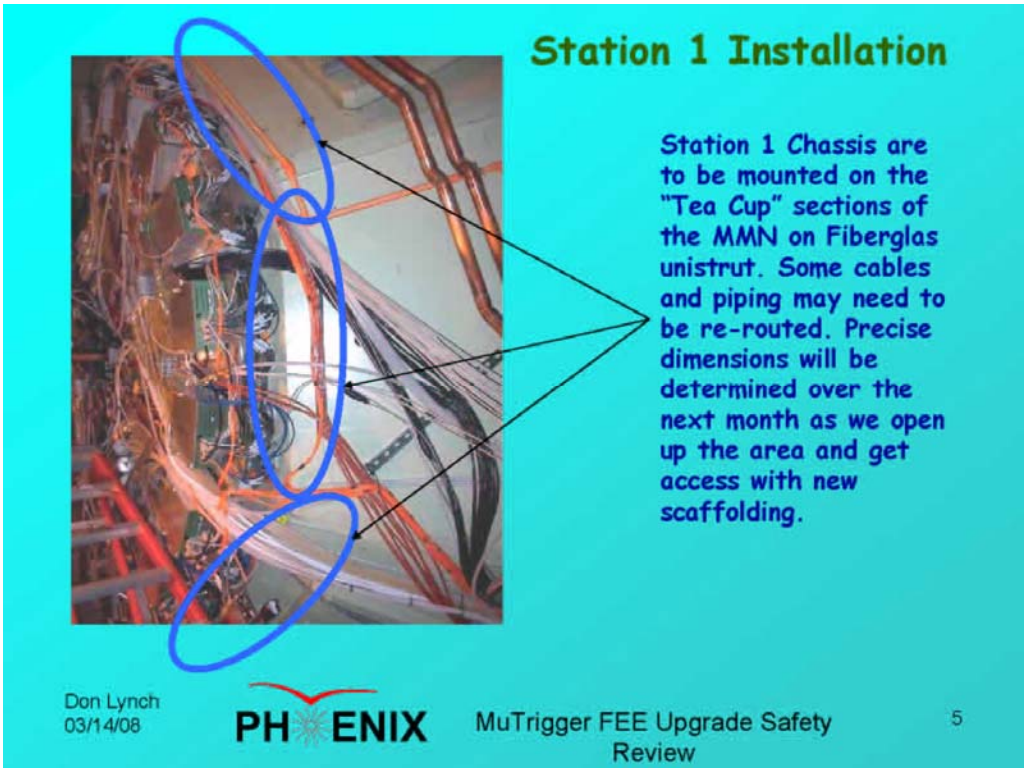

Figure 5:MuTrigger FEE Station 1 locations

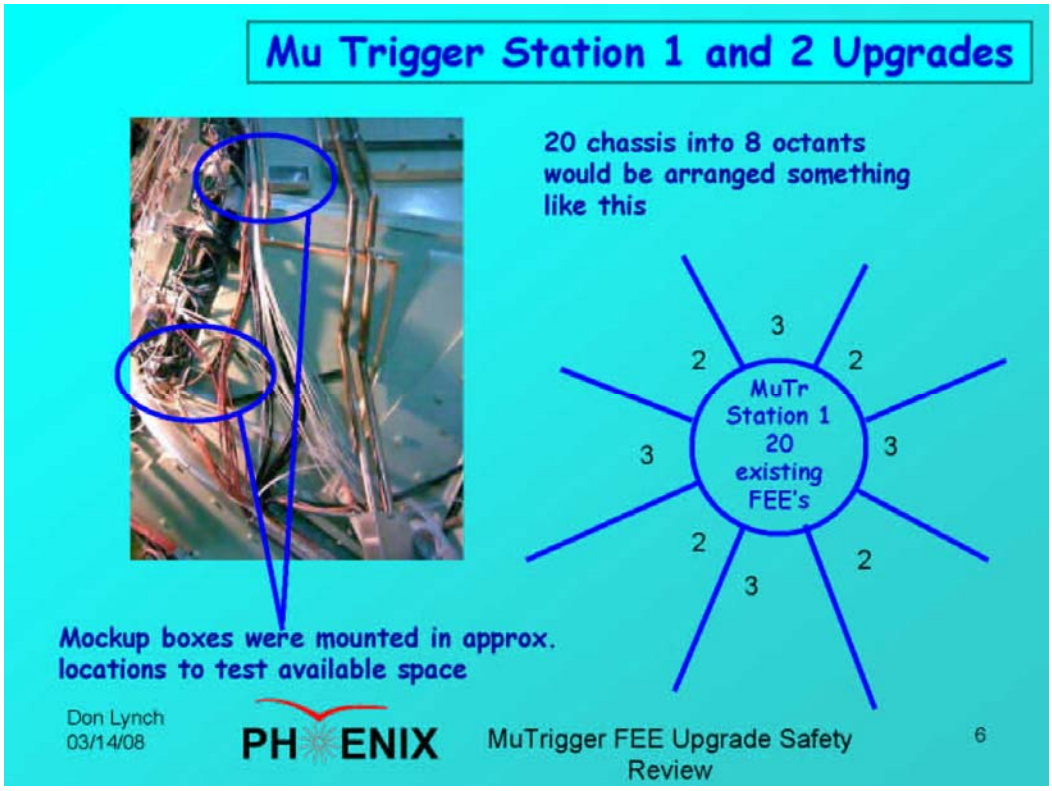

Figure 6: MuTrigger FEE Installation (Station 1)

Job Conclusion

After all planned tasks and testing have been completed satisfactorily, the scaffolding in both Station1 (north/south) and in the MMN shall be carefully disassembled in the revers procedure from its assembly. Before stowing equipment, technicians shall verify that each component is properly labeled and in good working order. The equipment shall then be stored in an appropriate location for future use.

A final closeout meeting shall be held involving all personnel who had worked on the 2 projects herein described, and problems, observations, deviations from the initial plan, etc. shall be recorded on the work permit. After the closeout meeting, the permit for the 2 projects shall be formally closed out.

(revised 6/20/2008)

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 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 mudsills properly placed and of adequate size?			
7. Have screw jacks been used to level and plumb scaffold instead of unstable objects such as; concrete blocks, loose bricks, etc.?			
8. Are base plates and/or screw jacks in firm and stable contact with ?			
9. Is scaffold level and plumb?			
10. Are all scaffold legs braced and are all braces properly attached?			
11. Is scaffold frame specifically designed to be used as ladder rungs? (Yes)			
12. Is the working level platform(s) fully planked? (N/A)			
13. Does the platform planking extend 6" to 12" beyond the supports points of the scaffold frame? (N/A)			
14. Is the scaffold platform free of makeshift devices or ladders to increase the working height of the scaffold?			
15. Are guardrails installed properly, including toeboards?			
16. Are guardrails in place on all open sides and ends of scaffold platforms above 6' in height?			
17. Have all joints been secured with set screw and torqued to mfr. tolerances (screw heads to be marked with paint to verify.			
18. Has scaffold been secured to building or structure at least every 30' in length and 26' in height?			
19. Have free standing towers been guyed or tied every 26' in height?			
20. Has scaffold been inspected and approved by C-A designated inspector(s)?			