BROOKHAVEN NATIONAL LABORATORY

Work Permit # DRL-2010-23
Work Order # _____
Job# _____ Activity# _____

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

Requester: Don Lynch	Date: 11/24/2010	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: 11/29/2010	Est. End Date: 12/24/2010
Brief Description of Work: Install RPC Prototype PE & Pb Absorbers & RPC! Prototype Detector			
Building: 1008	Room: IR	Equipment: Prototype RPC1 and PE & Pb Absorbers	Service Provider: PHENIX techs

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

ES&H ANALYSIS				
Radiation Concerns	☒ None	☐ Activation	☐ Airborne	☐ Contamination	☒ Radiation
Radiation Generating Devices:	☐ Radiography	☐ Moisture Density Gauges	☐ Soil Density Gauges	☐ X-ray Equipment
☐ Special nuclear materials involved, notify Isotope Special Materials Group			☐ Fissionable materials involved, notify Laboratory Criticality Officer	
Safety Concerns	☐ None	☐ Ergonomics	☐ Transport of Haz/Rad Material	
☐ Adding/Removing Walls or Roofs	☐ Confined Space*	☐ Explosives	☒ Lead*	☐ Penetrating Fire Walls
	☐ Corrosive	☐ Flammable	☐ Magnetic Field*	☐ Pressurized Systems
☐ Asbestos*	☐ Cryogenic	☐ Fumes/Mist/Dust*	☒ Material Handling	☒ Rigging/Critical Lift
☐ Beryllium*	☐ Electrical	☐ Heat/Cold Stress	☐ Noise*	☐ Toxic Materials*
☐ Biohazard*	☒ Elevated Work*	☐ Hydraulic	☐ Non-ionizing Radiation*	☐ Vacuum
☐ Chemicals*	☐ Excavation	☐ Lasers*	☐ Oxygen Deficiency*	☐ Other
* Does this work require medical clearance or surveillance from the Occupational Medicine Clinic? ☐ Yes ☒ No				
Environmental Concerns		☒ None	☐ Work impacts Environmental Permit No.	
☐ Atmospheric Discharges (rad/non-rad)		☐ Land Use	☐ 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:		☒ None ☐ 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”)	
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 prior to entry	
☐ Liquid Effluent	☐ Passive Vapor Monitor	☐ Sorbent Tube/Filter Pump		
Training Requirements (List below specific training requirements)				
CA –Collider User, PHENIX Awareness, Working at heights, rigging				
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)**	
ES&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):
The tasks described in this WP are part of the overall efforts related to the new RPC detector in which several detector and absorber stations have already been installed during the current and previous year maintenance shutdowns (RPC3N and RPC3S and the north and south stainless absorbers) and additional stations are planned for the future (RPC1N and RPC1S). These efforts have been, or will be, planned and described in other enhanced work permits. This permit and the attached procedure/plan are applicable only to the prototype installations of absorbers and detectors described herein.

Special Working Conditions Required:
None

Operational Limits Imposed:

Post Work Testing Required: No

Job Safety Analysis Required: ☐ Yes ☒ No | Walkdown Required: ☒ Yes ☐ No

Reviewed by: Primary Reviewer will determine the size of the review team and the other signatures required based on hazards and job complexity. Primary Reviewer signature means that the hazards and risks that could impact ES&H have been identified and will be controlled according to BNL requirements.

Title	Name (print)	Signature	Life #	Date
Primary Reviewer				
ES&H Professional				
Other				
Other				
Work Control Coordinator	Don Lynch		20146	
Service Provider				
	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 ES&H concerns or on ideas for improved job work flow. Use feedback form or space below.

5. Departmental Job Supervisor, Work Control Coordinator/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. Departmental Job Supervisor, Work Requester/Designee determines if Post Job Review is required. ☐ Yes ☐ No

Post Job Review (Fill in names of reviewers)

Name:	Signature:	Life#:	Date:
Name:	Signature:	Life#:	Date:

7. Worker provides feedback.

Worker Feedback (use attached sheets as necessary)
a) WCM/WCC: Is any feedback required? ☐ Yes ☐ No

b) Workers: Are there better methods or safer ways to perform this job in the future? ☐ Yes ☐ No

8. 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)

Name:	Signature:	Life#:	Date:
Comments:			

Attachment to W.P. #DRL-2010-23

Installation of RPC Prototype Polyethylene and Lead Absorbers and RPC1 Prototype Detector in the South "Flowerpot" Cavity of the PHENIX Central Magnet

Introduction

During the summer 2010 shutdown maintenance period PHENIX technicians have installed nearly 20 tons of stainless steel in the “flowerpot” cavities on the north and south sides of the PHENIX Central Magnet (CM). These absorbers are made of 310 Stainless Steel, chosen for its low permeability and resistance to permeability changes due to thermal and mechanical fabrication processes.

Analyses indicates that these absorbers will generate secondary background radiation that may be absorbed by additional layers of borated polyethylene and lead. Prototypes have been fabricated by the RPC group and will be installed (time permitting) near the end of the 2010 maintenance shutdown. These prototypes will shield the upper half of the south direction of PHENIX. The effectiveness of these absorbers will be evaluated, and if successful, the full 360 degrees, north and south cavities will be outfitted with a final design of the borated polyethylene and lead absorber.

In addition, the RPC group has assembled a prototype octant of the proposed future RPC1 detector. This prototype will be installed in the southeast quadrant of the CM south flowerpot external cavity, with its lower edge rotated 30 degrees up from vertical. The following illustrations demonstrate the methods and fixtures that will be utilized to install these prototypes.

I. Design

The absorber design requirements call for 2.5 cm (actual thickness = 1 inch) of borated polyethylene and 1 cm (actual thickness = 3/8 inch) of lead to be attached to the north and south outer sides of the PHENIX Central Magnet (CM) central poles in the conical cavities surrounding the PHENIX Beam-Beam Counter (BBC) subsystem and attached to the existing 36 cm of stainless steel type 310 previously installed. The BBC's are house in lead enclosures commonly referred to as the north and south "flower pots" (due to their shapes). The shape of the cavity is a frustum (truncated cone) within a frustum, the outer frustum formed by the inner walls of the cavity and the inner frustum by the flower pot, both frustums decreasing in diameter at the ends closest to the PHENIX IP. There will be 2 prototype quadrants to be installed in the south upper 2 quadrants attached to the existing stainless steel absorbers using 4 existing tapped holes in the stainless absorbers that had been used to attach to the absorber installation fixture.

The prototype absorbers are designed to match the outer dimensions of the outermost layer of stainless absorber and mounting holes matching the 4 tapped holes on the stainless absorbers. The prototypes are fabricated with matching holes to allow the borated polyethylene and lead

components to be bolted together using captive bolts and installed as 2 single assemblies. There are also 2 additional matching holes to accommodate a captive bolt for lifting with the PHENIX IR Crane. These 2 holes are located at the CG's for the east and west installed orientations. The borated polyethylene absorbers weigh approximately 57 lbs while the lead absorbers weigh 215 lbs, for an assembled installed weight of approximately 272 lbs. Although this is much lighter than the stainless absorbers it is much to heavy to be installed by hand and thus requires the PHENIX IR Crane.

In addition, an installation guide system has been designed to be constructed from customized unistrut components and fabricated connectors to guide the absorbers into their installed position, while preventing the assembly from contacting or even overhanging any unprotected section of the beampipe at any time during installation.

The prototype detector is smaller (octant) and lighter (37 lbs) and is mounted under the flowerpot and under the height of the beampipe. The detector will be installed by hand onto a fabricated 1/4 inch thick aluminum support structure (support structure weight is approximately 16 lbs) with 4 integral mounting bolts which align with mounting holes designed into the prototype detector. The support structure will be mounted to the outermost stainless absorber in the southeast quadrant of the flowerpot cavity using 4 bolts into the existing lifting fixture tapped holes on the stainless absorber.

II. Fabrication

Fabrication of the absorbers has been placed with an outside VENDOR thru the University of Illinois, Urbana.. Mounting hardware, mounting fixtures, and prototype detector support structure will be fabricated by BNL Central Shops (custom parts), purchased by PHENIX technical staff (off-the-shelf hardware and unistrut components), with minor modifications and assembly by PHENIX technicians as appropriate and in accordance with BNL contractual requirements, etc.

III. Prototype electronics support systems and gas system components .

In support of the RPC1 prototype PHENIX technicians shall install a rack on the PHENIX CM bridge platform, route cables, fibers and gas piping in accordance with accepted BNL practices as worker planned work both before and during RHIC run 11. The components used and details of these efforts shall be reviewed with CAD ESRC as necessary and appropriate.

IV. Procedure

This work is to be done by fully trained and experienced personnel (PHENIX mechanical technicians) during the 2010 maintenance shutdown prior to RHIC run 11.

(Please see the Borated Polyethylene and Lead Absorber Prototypes and RPC1 Prototype Illustrated Installation Plan for more detailed descriptions of each of the following steps.)

A. Prior to installation:

1. Read and understand all components of the work permit and attachments for this installation effort.

2. Cover the exposed section of beampipe south of the CM southside flowerpot with thick foam insulation.

3. Pre-assemble the prototype absorber installation guide fixture and install onto the vertical ring around the south CM flowerpot external cavity.

4. Pre-assemble and install the prototype RPC1 mounting fixture onto the lower southeast quadrant of the RPC stainless absorber.

B. **Prototype Absorber Installation**

The RPC prototype PE & Pb absorber is installed in 2 quadrants on the upper east and upper west outermost stainless steel RPC absorber quadrants. This operation requires 3 persons, 1 to operate the crane from the ground level and 2 in a manlift adjacent to the installation location.

1. Transport the west borated poly and lead prototype absorber assembly by any convenient means to the west side of the south station 1 of the MuTr without passing over the beampipe.

2. Orient the prototype assembly in the approximate configuration that it will be installed and attach the lifting apparatus and guide trolley to a captive bolt in the upper lifting hole for the assembly.

3. Using the IR west 1 ton crane, lift the prototype assembly to the waiting technicians and position the trolley in the unistrut track.

4. Install the safety stop bolt to prevent the trolley from traveling out of the guide track

5. Lower the crane cable to allow the trolley to take the load while the cable relinquishes the load.

6. Disconnect the crane cable and reposition the crane apparatus to somewhere conveniently out of the way.

7. Roll the trolley into the absorber installation position rotating the prototype absorber as necessary to position it around the south flowerpot and allow the bottom edge of the prototype absorber to sit on the unistrut ledge attached to the lower stainless absorber using a crowbar for leverage, nudge the prototype absorber along the ledge as necessary until the mounting holes of the prototype absorber align with the tapped

holes of the adjacent stainless absorber.

8. Bolt the prototype absorber to the adjacent stainless absorber using 4 M14 bolts.

9. Repeat the mirror image of this process to install the upper southeast prototype absorber.

10. After both prototype absorbers have been installed, carefully remove all of the installation guide fixture components and hardware.

RPC1 Prototype Detector Installation

1. Place the prototype detector in the manlift with 2 PHENIX techs inside.

2. Elevate the detector prototype to near its installation fixture with the manlift.

3. Align the prototype detector with the for mounting bolts on the prototype detector support structure and make sure the 4 mounting bolts of the support structure pass through the 4 mounting holes and insulating grommets, then fasten the prototype with 4 locking nuts.

4. Attach the appropriate cables, gas piping, fibers etc. and route as appropriate in accordance with best PHENIX worker planned work practices.

V. Work conclusion

When all work described in this work permit has been completed, the PHENIX work coordinator for this set of tasks shall collect feedback from all parties (PHENIX engineers and technicians and RPC experts). This feedback shall include critical review of any problems encountered during installation, solutions to such problems, changes to work procedures described herein during the conduct of this work, suggestions for improvements in equipment procedures and techniques and any other information deemed useful and/or relevant by the PHENIX work control coordinator. Such information shall be appropriately disseminated to the various affected/interested parties and a copy of this information shall be attached to this work permit when it is closed out. Any lessons learned shall be applied to the future installations of absorbers and detectors as anticipated for next year.

Borated Polyethylene and Lead Absorber Prototypes and RPC1 Prototype Installation Plan

During the 2010 Maintenance Shutdown

Don Lynch

11/24/2010

Absorber Installation

During the summer 2010 shutdown maintenance period PHENIX technicians have installed nearly 20 tons of stainless steel in the "flowerpot" cavities on the north and south sides of the PHENIX Central Magnet (CM). These absorbers are made of 310 Stainless Steel, chosen for its low permeability and resistance to permeability changes due to thermal and mechanical fabrication processes.

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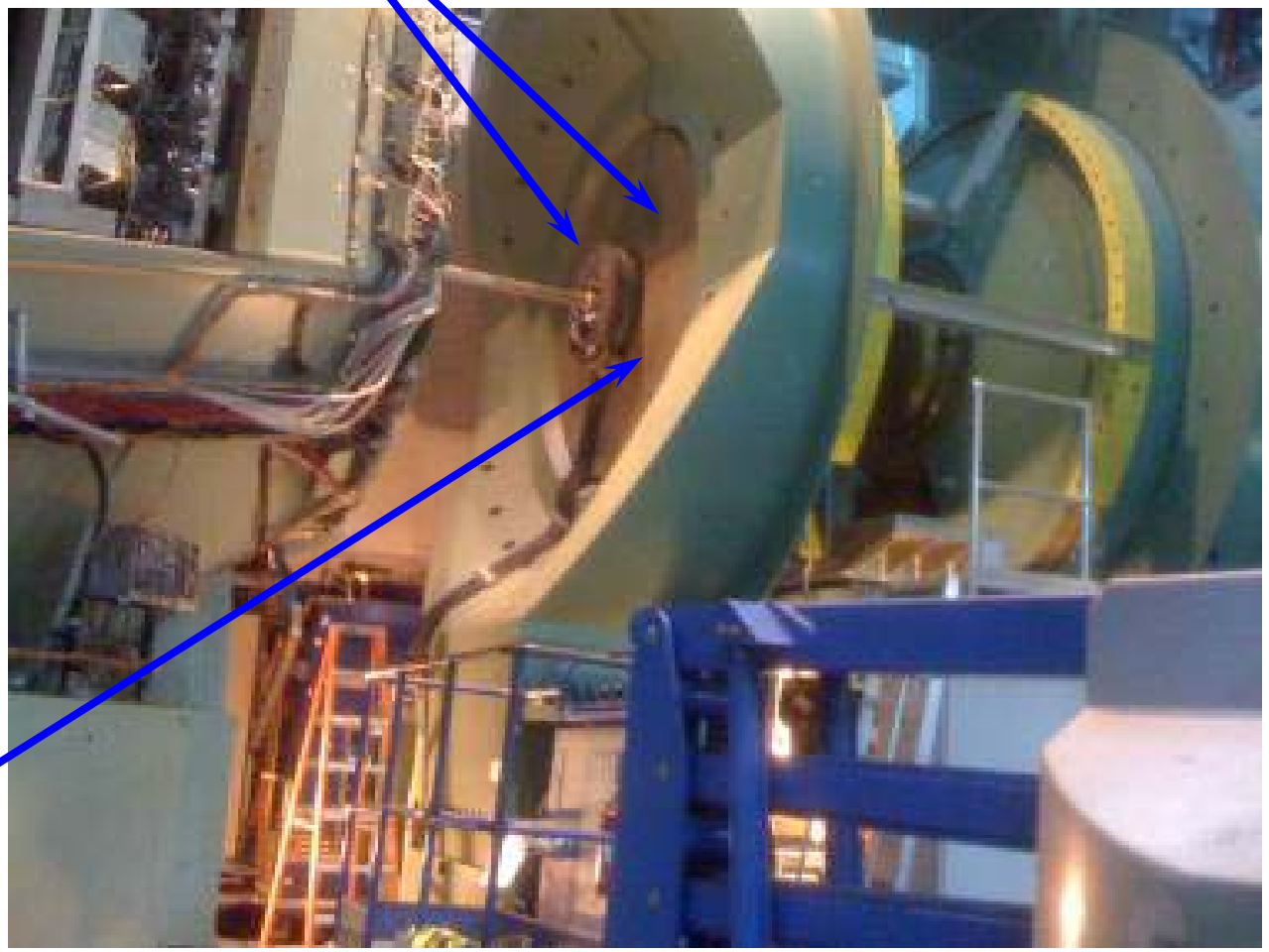
Prototype Absorbers go here

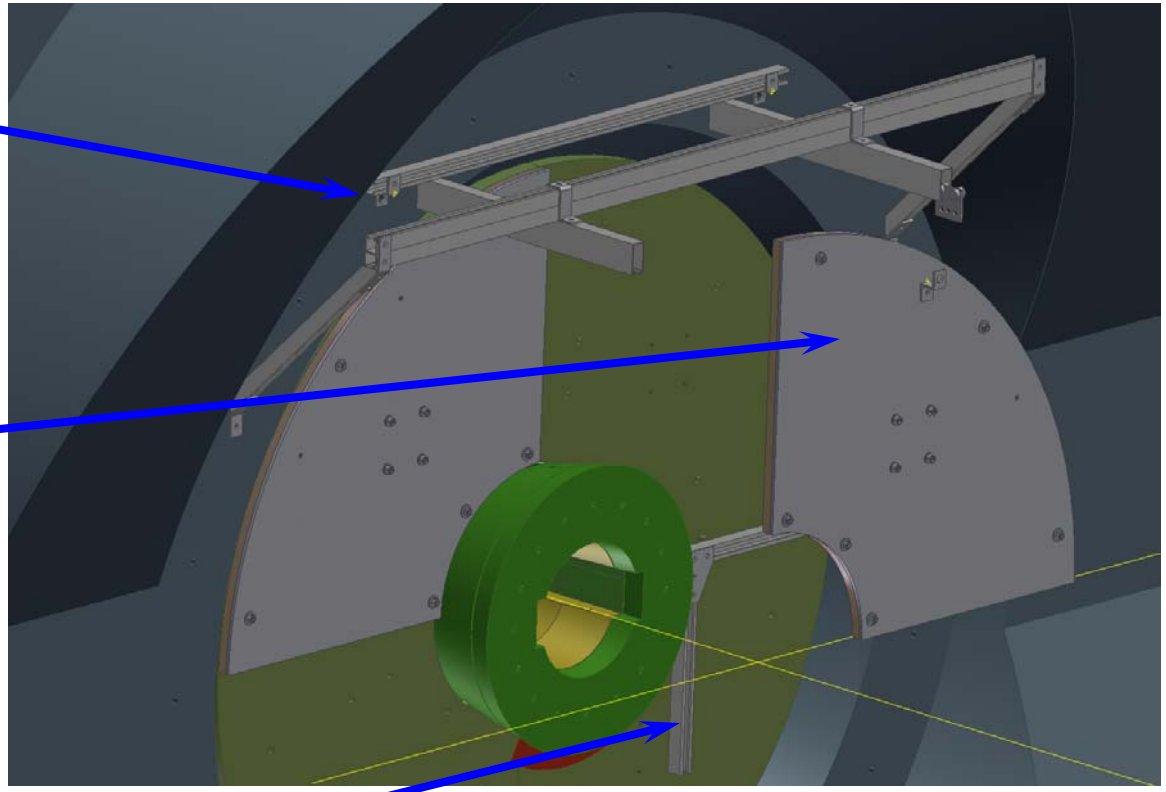


RPC1
Prototype
Goes Here

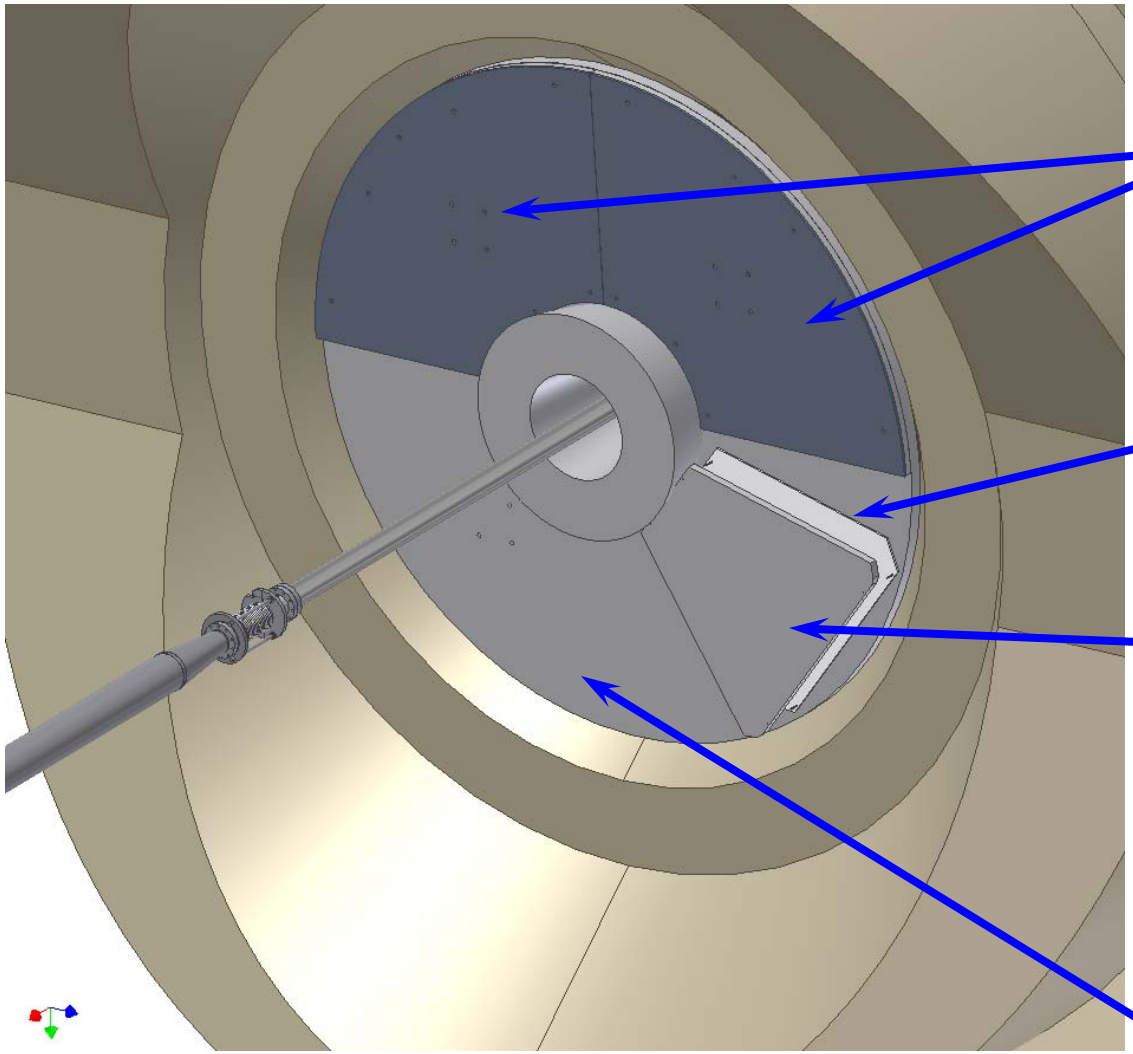
Installation scheme for Borated Poly and lead prototypes:

Installation support structure attached to CM

Prototype absorbers lifted with crane , attached to installation support structure by trolley and slid into position



Shelf support to help align and position absorber prototypes.


Installed Borated
Poly & Lead Absorber
Prototypes
RPC1 Prototype
Support Structure
RPC1 Prototype
Installed Stainless
Absorbers

Safety

- What Safety issues do we know of?
  - Communication
  - Site hazards (Crane)
  - Proximity to Beampipe
  - Work Coordination, Working at heights
  - Other
- What potential hazards may exist that we haven't identified
  - Access issues
  - Unplanned changes to work schedule
  - Manpower issues
  - Changes to conditions
- How do we deal with these
  - Stop, ask questions, re examine
  - Appropriate PPE
  - Careful planning
  - Pre-assemble installation fixture and loads near ground level and test lifts with crane near ground level to establish control over random movements and CG control