

Fermilab

Radiological Work Permit No. AD-20-140

Area Name

MI Collimators

Permit Type Job-Specific

Issue Date Sep 11, 2020

Issue Time 12:05 PM

Expiration Date Nov 30, 2020

Description of Work

This RWP will cover two jobs in the MI-30 collimator regions. First will be restoring horizontal motion to the collimators and then installing collimator inserts. There is an ALARA plan associated with each job.

Access Type

- Controlled Access
- Supervised Access
- Open Access
- Other - Secured Area
- N/A

Basic Work Area Conditions

Poor lighting - bring supplemental lighting

Additional Work Area Conditions

None

Area Posting

High Radiation Area

Contamination Area

Deenergize motors prior to connection to hand controller when used

Time Limits

None

Dose Limits

See ALARA plans and individual checkpoints and job-stop limits.

Work Documents

see attached job plan(s)
HA when applicable

Dosimetry Requirements

- None Required
- Dosimetry Badge
- Pocket Dosimeter
- Ring Badge
- Digidose
- See Special Requirements

Basic Training Requirements

Radiological Worker Training

Other Training Requirements

None

Portable Survey Instruments

- None Required
- LSM
- Ludlum 14C
- E140N/Portable Frisker
- Minimeter
- Teletector
- Bicron Analyst
- See Special Requirements

Minimum Personal Protective Equipment

- None Required
- Gloves
- Shoecovers
- Labcoats
- Coveralls
- Hood
- Eye Protection
- Respiratory Protection
- See attached instructions
- See special requirements

Additional Instructions

- Notify ESH&Q Prior to Work
- Rad Tech Coverage Required
- Review Survey Map
- Pre-Job Briefing
- Personal Frisk on Exit
- Survey & Label Materials on Exit
- Post-Job De-Briefing
- No Eating, Drinking, Smoking
- See Special Requirements

SPECIAL REQUIREMENTS

Work stops at collective dose as per each ALARA plans. RSO or designee approval required before proceeding if work is stopped. RCT(s) will conduct radiation surveys as necessary, will provide supplemental dosimetry as needed and provide instructions for placement. Take precautions to prevent the spread of contamination. If water on the floor is encountered, rubber boots must be worn and herculite must be placed to prevent contact with personnel. Parts of these jobs will also require lab coats and/or coveralls. Wear PPE as directed by the RCT. Dispose of all PPE in rad bags. All activated components are assumed to be contaminated.

Prepared By

Susan McGimpsey

RSO Authorization

Names of Workers, Signatures, and Further Instructions

Name of Worker	Fermi ID	Worker Signature and Date
Dale White	10017	Dale White 9/14/20
Mike Coburn	5558	[Signature]
Beth Klein	37908	Beth Klein
KYLE HAZELWOOD	14740	[Signature] 15SEP20
ROBERT AINLUR TH	30815N	[Signature]
PHIL ADAMSON	13563N	[Signature]
Chris Guttus	8022 N	[Signature]
Dave Capista	6527	Dave Capista
DENTON MORRIS	8194	[Signature] 9/15/2020
J. B. Hely	14869	[Signature]
Elias Lopez	31120N	[Signature] 10/06/20
ROM BACINO	8961C	R. Bacino 10/6/2020
John Anderson	1288C	[Signature] 10/6/2020
Jason Kuback	13729N	[Signature] 10/15/2020
Ryan Monticell	12545N	[Signature] 10/15/20
ADRIAN MARQUEZ	35076N	[Signature] 10/15/2020
Nino Chelidze	34887N	N. Chelidze 10/29/2020
BLASZYNSKI WOJCIECH	13164	[Signature]

Further Instructions

None

RR-300 Region Collimators ALARA

RWP AD-20-140

MI 300 area collimator Horizontal Motion Restoration & Insert Installation as per ALARA plan.

Insert Installation Person-mRem

Name	Dose (mRem)
ES&H	
Dale White	17
Sue McGimpsey	0
AD/MS	
Beth Klein	3
John Anderson	21
Rom Bacino	10
Justin Briney	10
Elias Lopez	0
Ryan Montiel	23
Jason Kubinski	27
Adrian Marquez	0
Wojciech Blaszyński	15
MI	
Denton Morris	3
Phil Adamson	7
Total	136.0

Summary

10/6 & 10/15-16/20 Person-mrem for this job was 136 with an estimate of 752

307:Person-mrem 22 estimate 200

303:Person-mrem 32 estimate 164

301:Person-mrem 82 estimate 388

The main scope of this job was to install inserts in the beamline on the downstream side of three collimators; 307, 303 and 301 in that order. The inserts are designed to aid in keeping the beam focused thereby minimizing beam losses. The lowest rad levels are at 307 collimator so this went first to learn as the job progressed to minimize radiation doses. Doserate in area worked varied from location to location, see ALARA for more info. The first attempt on 10/6 at 307 had some problems. The screws were not threading in properly so all the parts for each location had to be re-machined. This resulted in getting 7 extra mrem. Job started back up 10/15. Inserts went in reasonably well and job went as smooth as possible. Overall dose was well below what was initially thought.

As per RWP requirements, workers wore full anti-c's with double shoe covers and gloves. Full set of protective clothing were removed and placed in a bag and sorted through after completion of job disposing of contaminated items as rad waste. Personnel and items were checked periodically and when switching locations. A few items had to be de-coned along the way. The guide tool scraped inside the beamline and had a few hundred counts above background that was fixed. This item was bagged and disposed of as radiation waste.

Horizontal Restoration Person-mRem

Name	Dose (mRem)
ES&H	
Dale White	14
Nino Chelidze	4
AD/MS	
Beth Klein	6
John Anderson	7
Controls	
Mike Coburn	40
MI	
Kyle Hazelwood	10
Phil Adamson	10
Rob Ainsworth	9
Dave Capista	23
Denton Morris	15
Cons Gattuso	16
Total	154.0

Summary

9/15-11/23/20 Person-mrem for this job was 154 with a total estimate of 883

307:Person-mrem 22 estimate 87

Add on 2 estimate 5

Total 24 estimate 92

308:Person-mrem 26 estimate 217

Add on 3 estimate 15

Total 29 estimate 232

303:Person-mrem 19 estimate 116

Add on 3 estimate 6

Total 22 estimate 122

301:Person-mrem 40 estimate 399

Add on 6 estimate 26

Horizontal Investigation/Repair 33 estimate 12

Total 79 estimate 437

The main scope of this job was to restore Horizontal motion for 4 collimators; 307, 308, 303 and 301 in that order. Doserates for areas worked can be found on ALARAs. LVDT replacement was cancelled as parts were not in yet and it is also believed that these are not damaged. After attempting to place hard stops in at 307 it was discovered they did not fit in as planned so that step was eliminated for all collimators. Switch blocks were replaced and burndy connector repaired. An add on was made to the ALARA to adjust Switch Block assemblies for each location. This only resulted in a small amount of exposure. After testing each location it was discovered 301 Horizontal motion was not fully operational. This resulted in an add on to the ALARA. After investigating problem it was discovered that the motor was bad. This motor was replaced.

As per RWP requirements, workers wore full anti-c's with double shoe covers and gloves. Full set of protective clothing were removed and placed in a bag and sorted through after completion of job disposing of contaminated items as rad waste. Personnel and items were checked periodically and when switching locations.

AD-20-140 Restoration of Horizontal Movement for MI307 Collimator									
All items presumed to be radioactively contaminated									
Job Stop limit =		109 mrem (incl. 25% contingency)							
Individual checkpoint =		75 mrem per person, and not to exceed 300 mrem per quarter							
STEP	TIME	NUMBER	EXPOSURE	TOTAL ESTIMATED	DOSE	COMMENTS			
	hours	OF	RATE	COLLECTIVE DOSE	RECEIVED				
		PEOPLE	mR/hr.	person mrem	mrem				
307 Collimator									
1	0.05	2	8	0.8	0				
Remove Barricade									
307 US									
*2	0.1	1	65	6.5					
Remove LVDT and bracket assembly									
*3	0.05	1	65	3.25					
Remove LVDT Tee									
*4	0.1	1	65	6.5					
Install new LVDT tee and LVDT and bracket assembly									
*5	0.05	1	65	3.25					Not performed
Apply Clamp and Connector									
6	0.05	1	20	1	5				
Place hard stop between collimator and wall									
307 DS									
7	0.1	1	100	10					
Remove switch block assemblies (2)									
8	0.1	1	100	10					
Remove right and left switch angles									
9	0.1	1	100	10					
Install new right and left switch angles. Align to correct positions									
10	0.1	1	100	10	11				
Install new switch block assemblies (2)									
11	0.05	1	100	5	1				
Remove existing 3 Burndy pins and install new ones.									
12	0.05	1	30	1.5					Not performed
Place hard stop between collimator and wall									
13	0.4	2	5	4	2				
Test system to make sure everything works properly									
Rad Coverage									
			Total	86.8	22				
Add on (10/1)									
	0.05	1	100	5	2				
Adjust both switch angles									
				5	2				
				91.8	24				

AD-20-140 Restoration of Horizontal Movement for MI308 Collimator							
All items presumed to be radioactively contaminated							
Job Stop limit =		272 mrem (incl. 25% contingency)					
Individual checkpoint =		75 mrem per person, and not to exceed 300 mrem per quarter					
STEP	TIME	NUMBER OF PEOPLE	EXPOSURE RATE	ESTIMATED COLLECTIVE DOSE	DOSE RECEIVED	COMMENTS	TOTAL
							ESTIMATED COLLECTIVE DOSE person mrem
308 Collimator							
1	0.05	2	6	0.6	0		
2	0.02	1	10	0.2			
308 US							
3	0.1	1	30	3			
4	0.05	1	30	1.5			
5	0.1	1	30	3			
6	0.05	1	30	1.5			
7	0.05	1	10	0.5		Not performed	
8	0.02	1	2	0.04			
308 DS							
9	0.1	1	400	40			
10	0.1	1	400	40	7		
11	0.1	1	400	40			
12	0.1	1	400	40	11		
13	0.05	1	400	20	2		
14	0.05	1	100	5		Not performed	
15	0.4	2	2	1.6			
16	0.05	2	5	0.5	3		
Rad Coverage							
				20	3		
				217.44	26		
Add on (10/1)							
	0.05	1	300	15	3		
				15	3		
				232.44	29		

AD-20-140 Restoration of Horizontal Movement for MI303 Collimator							
	All items presumed to be radioactively contaminated						
	Job Stop limit =	145 mrem (incl. 25% contingency)					
	Individual checkpoint =	75 mrem per person, and not to exceed 300 mrem per quarter					
STEP	TIME	NUMBER OF PEOPLE	EXPOSURE RATE mR/hr.	TOTAL ESTIMATED COLLECTIVE DOSE person mrem	DOSE RECEIVED mrem	COMMENTS	
	303 Collimator						
1	Remove Barricade	2	15	1.5	0		
	303 US						
2	Remove LVDT and bracket assembly	1	100	10			
3	Remove LVDT Tee	1	100	5			
4	Install new LVDT tee and LVDT and bracket assembly	1	100	10			
5	Apply Clamp and Connector	1	100	5			
6	Place hard stop between collimator and wall	1	50	2.5		Not performed	
	303 DS						
7	Remove switch block assemblies (2)	1	115	11.5			
8	Remove right and left switch angles	1	115	11.5	6		
9	Install new right and left switch angles. Align to correct positions	1	115	11.5			
10	Install new switch block assemblies (2)	1	115	11.5	6		
11	Remove existing 3 Burndy pins and install new ones.	1	115	5.75	2		
12	Place hard stop between collimator and wall	1	50	2.5		Not performed	
13	Test system to make sure everything works properly	2	10	8	2		
	Rad Coverage			20	3		
				116.25	19		
	Add on (10/1)						
	Adjust both switch angles	1	110	5.5	3		
				5.5	3		
				121.75	22		

AD-20-140 Restoration of Horizontal Movement for MI301 Collimator									
All items presumed to be radioactively contaminated									
Job Stop limit =		499 mrem (incl. 25% contingency)							
Individual checkpoint =		75 mrem per person, and not to exceed 300 mrem per quarter							
STEP		TIME	NUMBER OF PEOPLE	EXPOSURE RATE	ESTIMATED COLLECTIVE DOSE	DOSE RECEIVED	COMMENTS		
		hours		mR/hr.	person mrem	mrem			
	301 Collimator								
1	Remove Barricade	0.05	2	15	1.5	0			
2	Change Light Bulbs	0.17	1	15	2.55				
3	Turn off ion pump(remotely). Disconnect HV connector	0.02	1	30	0.6				
	301 US								
4	Remove LVDT and bracket assembly	0.1	1	250	25				
5	Remove LVDT Tee	0.05	1	250	12.5				
6	Install new LVDT tee and LVDT and bracket assembly	0.1	1	250	25				
7	Apply Clamp and Connector	0.05	1	250	12.5				
8	Place hard stop between collimator and wall	0.05	1	70	3.5				
9	Put ion pump feedthrough back/Connect HV	0.02	1	30	0.6		Not performed		
	301 DS								
10	Remove switch block assemblies (2)	0.1	1	600	60				
11	Remove right and left switch angles	0.1	1	600	60	9			
12	Install new right and left switch angles. Align to correct positions	0.1	1	600	60				
13	Install new switch block assemblies (2)	0.1	1	600	60	19			
14	Remove existing 3 Burndy pins and install new ones.	0.05	1	600	30	3			
15	Place hard stop between collimator and wall	0.05	1	150	7.5		Not performed		
16	Test system to make sure everything works properly	0.4	2	10	8	4			
	Rad Coverage				30	5			
	SubTotal				399.25	40			

STEP	TIME	NUMBER OF PEOPLE	EXPOSURE RATE	ESTIMATED COLLECTIVE DOSE	DOSE RECEIVED	COMMENTS
Add on (10/1)						
Adjust both switch angles	0.05	1	500	25	3	
Re-wire Primary Collimator to series	0.15	1	10	1.5	3	
			SubTotal	26.5	6	
Add on (10/6) Investigate 301 H Movement						
Remove the top side cover to allow visual observation of motor drive motion.	0.05	1	10	0.5		
Test motion in the tunnel with a portable 6 amp stepper driver to verify the behavior.	0.2	1	10	2	12	
If the motor works fine we need to understand why one 6 amp driver works while the other doesn't.						
If the motor still stalls:						
Remove guard rail and side cover to open up more observation options. Move the collimator with the portable 10 amp controller and inspect for binding, alignment issues or possible damage.	0.2	2	10	4		
Re-align components if necessary. Identify any components needed to be replaced.	0.1	2	10	2	17	
Rad Coverage				3	4	
			SubTotal	11.5	33	
			Total	437.25	79	

AD-20-140 Inserts for MI307 Collimator									
All items presumed to be radioactively contaminated									
Job Stop limit =		250 mrem (incl. 25% contingency)							
Individual checkpoint =		75 mrem per person, and not to exceed 300 mrem per quarter							
STEP		TIME	NUMBER OF PEOPLE	EXPOSURE RATE	TOTAL ESTIMATED COLLECTIVE DOSE	DOSE RECEIVED	COMMENTS		
		hours	PEOPLE	mR/hr.	person mrem	mrem			
307 Collimator									
1	Stage Equipment	1.25	4	5	25				
2	Vent Vacuum Sector 307-309	0.2	2	10	4	1			
3	Disconnect 2 Flanges to Remove Downstream Bellows	0.08	2	100	16	3			
4	Inspect Collimator (MI Department)	0.02	2	125	5	0			
5	Install Collimator Insert Assembly	0.1	1	125	12.5	5			
6	Prep Seals and Polish Bellows Vacuum Flange Faces	0.25	2	100	50				
7	Inspect Assembly (MI Department)	0.02	2	100	4	2			
8a	Connect Upstream Flange to Install Bellows	0.2	1	100	20				
8b	Connect Downstream Flange to Install Bellows	0.2	1	40	8	3			
9	Replace Aisle Barricade	0.05	2	8	0.8				
10	Pump Down and Leak Check Vacuum System	1	2	20	40	4			
	Rad Coverage				15	4			
					200.3	22			

AD-20-140 Inserts for MI303 Collimator												
All items presumed to be radioactively contaminated												
Job Stop limit =		205 mrem (incl. 25% contingency)										
Individual checkpoint =		75 mrem per person, and not to exceed 300 mrem per quarter										
STEP		TIME	NUMBER	EXPOSURE	TOTAL ESTIMATED	DOSE	COMMENTS					
		hours	OF PEOPLE	RATE mR/hr.	COLLECTIVE DOSE person mrem	RECEIVED mrem						
303 Collimator												
1	Stage Equipment	0.2	2	10	4							
2	Vent Vacuum Sector 301-305	0.2	2	30	12	1						
3	Disconnect 2 Flanges to Remove Downstream Bellows	0.08	2	110	17.6	6						
4	Inspect Collimator (MI Department)	0.02	2	125	5	2						
5	Install Collimator Insert Assembly	0.1	1	125	12.5	8						
6	Prep Seals and Polish Bellows Vacuum Flange Faces	0.25	2	100	50	4						
7	Inspect Assembly (MI Department)	0.02	2	100	4	1						
8a	Connect Upstream Flange to Install Bellows	0.2	1	110	22							
8b	Connect Downstream Flange to Install Bellows	0.2	1	50	10	6						
9	Replace Aisle Barricade	0.05	2	15	1.5	4						
					25							
					163.6	32						

Rad Coverage

	AD-20-140 Inserts for MI301 Collimator															
	All items presumed to be radioactively contaminated															
	Job Stop limit =	484 mrem (incl. 25% contingency)														
	Individual checkpoint =	75 mrem per person, and not to exceed 300 mrem per quarter														
STEP		TIME	NUMBER	EXPOSURE	ESTIMATED	DOSE	COMMENTS									
		hours	OF	RATE	COLLECTIVE	RECEIVED										
			PEOPLE	mR/hr.	DOSE	DOSE										
					person mrem	mrem										
	301 Collimator				TOTAL											
1	Stage Equipment	0.2	2	10	4											
2	Disconnect 2 Flanges to Remove Downstream Bellows	0.08	2	300	48	3										
3	Inspect Collimator (MI Department)	0.02	2	200	8	3										
4	Install Collimator Insert Assembly	0.1	1	200	20	15										
5	Prep Seals and Polish Bellows Vacuum Flange Faces	0.25	2	200	100	24										
6	Inspect Assembly (MI Department)	0.02	2	200	8	2										
7a	Connect Upstream Flange to Install Bellows	0.2	1	500	100											
7b	Connect Downstream Flange to Install Bellows	0.2	1	100	20	10										
8	Replace Aisle Barricade	0.05	2	15	1.5											
9	Pump Down and Leak Check Vacuum System	1	2	20	40	14										
10	Remove Equipment from Tunnel	0.4	4	5	8	2										
	Rad Coverage				30	9										
					387.5	82										

Post-Job Critique and Analysis

Should include comments on such factors as:

Written by: *Dale White*

Reviewed by: *Sue McGimpsey*

Doses actually received versus anticipated doses, whether ALARA goals were met, whether work procedures and controls were adequate, and suggestions for improvements

Horizontal Motion Summary

9/15-11/23/20 Person-mrem for this job was 154 with a total estimate of 883

307:Person-mrem 22 estimate 87

Add on 2 estimate 5

Total 24 estimate 92

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Total 29 estimate 232

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Name	Dose (mRem)	Controls	MI
ES&H			
Dale White	14	Mike Coburn 40	Dave Capista 23
Nino Chelidze	4	MI	Denton Morris 15
AD/MS		Kyle Hazelwood 10	<u>Cons Gattuso 16</u>
Beth Klein	6	Phil Adamson 10	Total 154.0
John Anderson	7	Rob Ainsworth 9	

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Post-Job Critique and Analysis - Page 2

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Inserts Summary

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Name Dose (mRem)

ES&H

Dale White 17
Sue McGimpsey 0

AD/MS

Beth Klein 3
John Anderson 21
Rom Bacino 10
Justin Briney 10
Elias Lopez 0
Ryan Montiel 23
Jason Kubinski 27
Adrian Marquez 0
Wojciech Blaszyński 15

MI

Denton Morris 3
Phil Adamson 7
Total 136.0