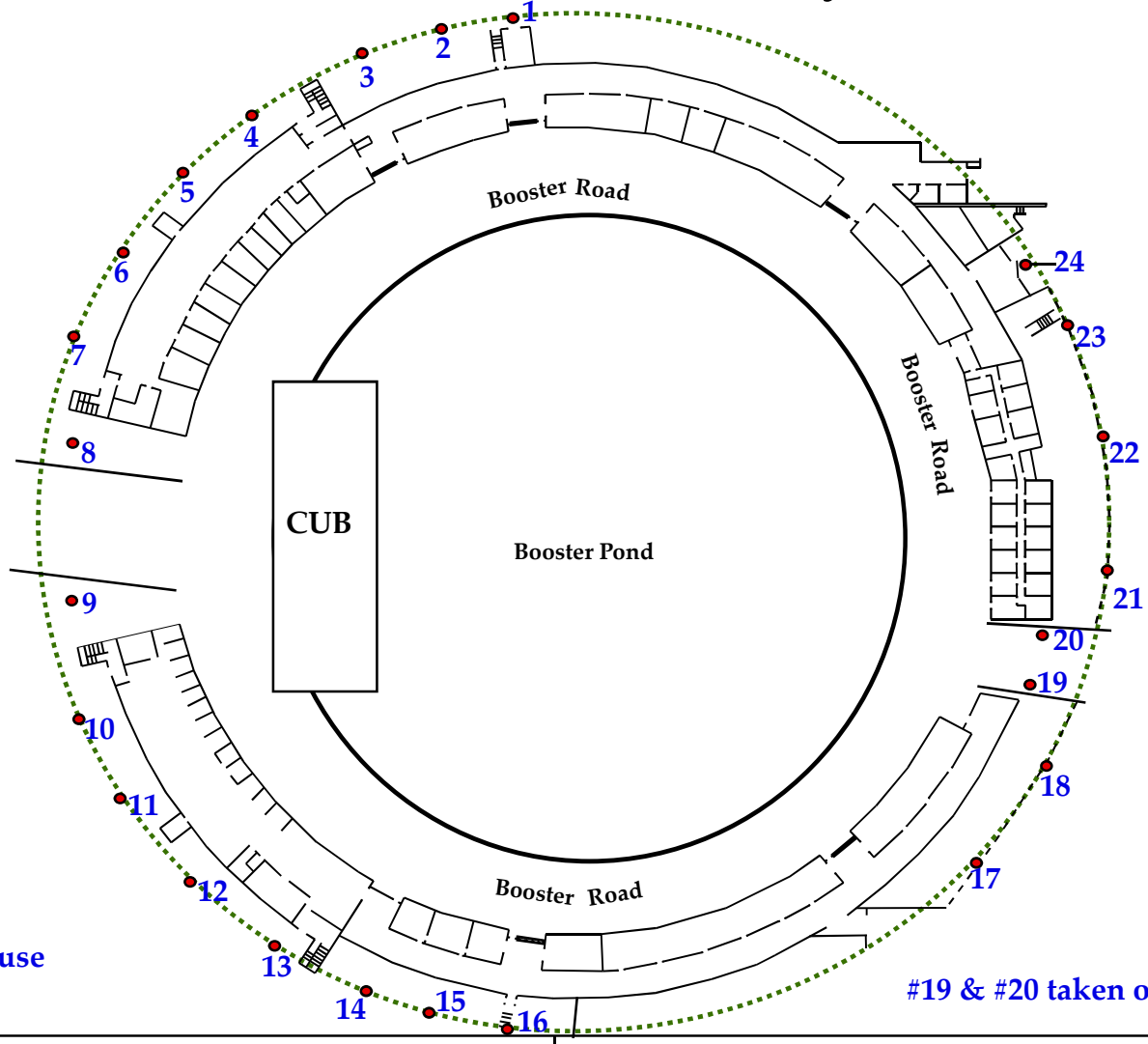
Fermilab
ES&H

DATE: 10/9/20	TIME: 1400	PURPOSE: Background

Booster Beam- On Survey



SURVEY POINTS

SURVEY POINT #1:	1,508
SURVEY POINT #2:	1,207
SURVEY POINT #3:	1,214
SURVEY POINT #4:	2,867
SURVEY POINT #5:	3,055
SURVEY POINT #6:	2,747
SURVEY POINT #7:	2,605
SURVEY POINT #8:	2,319
SURVEY POINT #9:	2,648
SURVEY POINT #10:	2,535
SURVEY POINT #11:	2,503
SURVEY POINT #12:	2,654

SURVEY POINTS

SURVEY POINT #13:	2438
SURVEY POINT #14:	1,588
SURVEY POINT #15:	1,502
SURVEY POINT #16:	1,799
SURVEY POINT #17:	1,699
SURVEY POINT #18:	1,687
SURVEY POINT #19:	1,433
SURVEY POINT #20:	1,380
SURVEY POINT #21:	1,874
SURVEY POINT #22:	1,996
SURVEY POINT #23:	1,796
SURVEY POINT #24:	1,317

#8 & #9 Location of Doghouse

#19 & #20 taken on center of road asphalt

All Areas <_NA_____ mR/hr@1foot (Unless otherwise indicated)

Highest Dose Rate Found:____NA_____mR/hr@1foot

Radiation Instruments Used

Inst Type:	Bicron Analyst		
Inst No:	#68	N/A	N/A
Batt/Source Chk:	Sat/Sat		
Cal. Due Date:	Sept. / 2021		
Background:	See Map		

LEGEND

- Dose Rate in mR/hr @ 1 ft. * - Unlabeled Radioactive Material

(#R)- Radioactive Material Wipe (#) - Wipe (#F)- Floor Wipe

Bkgd _____ cpm

Wipe #	Reading		Wipe #	Reading	
____	_____	ccpm	____	_____	ccpm
____	_____	ccpm	____	_____	ccpm
____	_____	ccpm	____	_____	ccpm
____	_____	ccpm	____	_____	ccpm
____	_____	ccpm	____	_____	ccpm

N/A N/A

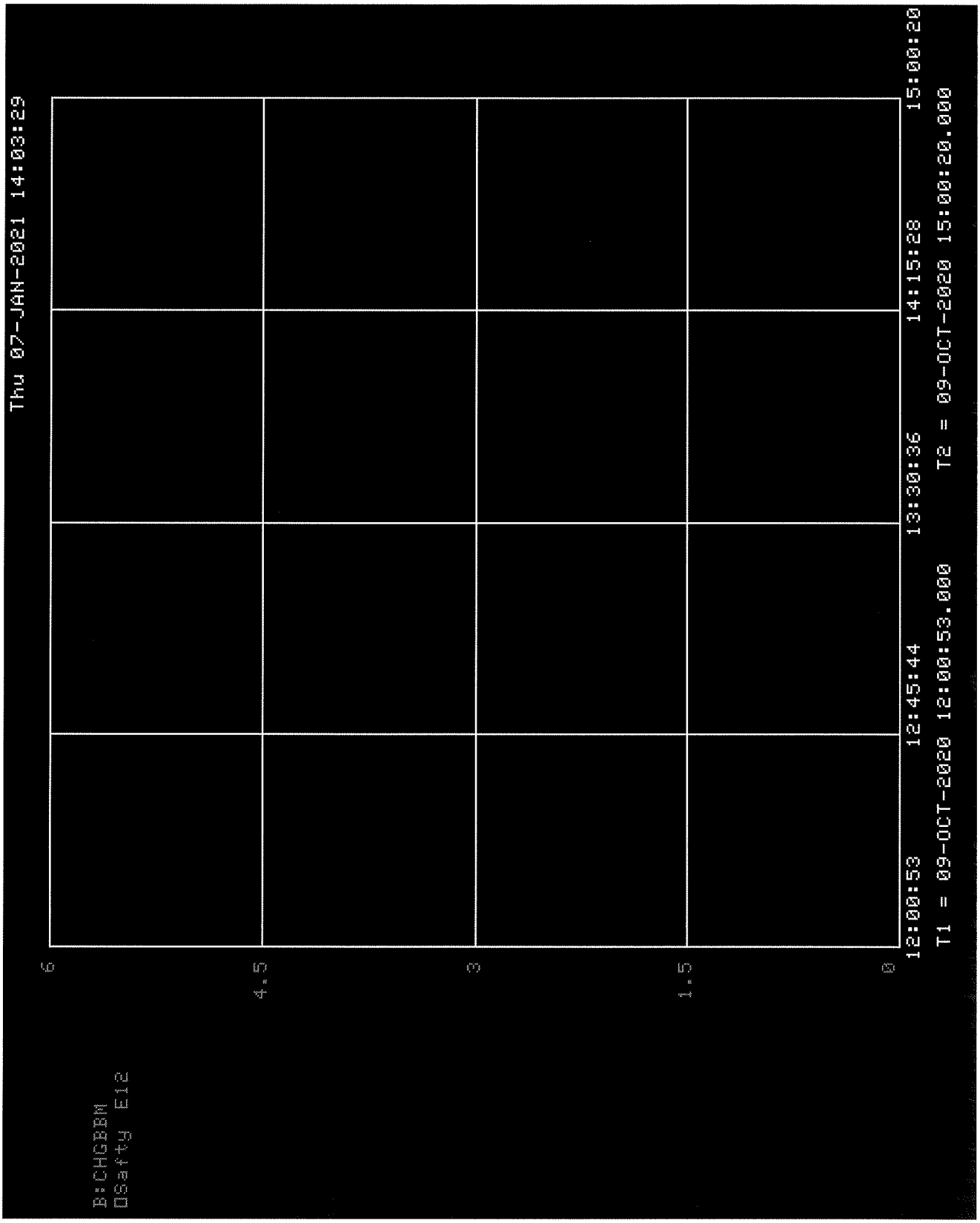
Comments:

Background survey with beam off. The survey points were taken at roughly the edge of the perimeter (~ 10 feet off the wall) of the Booster Ring building.
Readings are 1 minute integration using the Analyst scaler
No neutron background taken due to no neutron source from the beam.

Surveyed By: *Jose De La O #4175*

Reviewed By: Maddie Schoell, UID:maddiew Digitally signed by Maddie Schoell, UID:maddiew Date: 2021.02.02 11:05:59 -06'00'

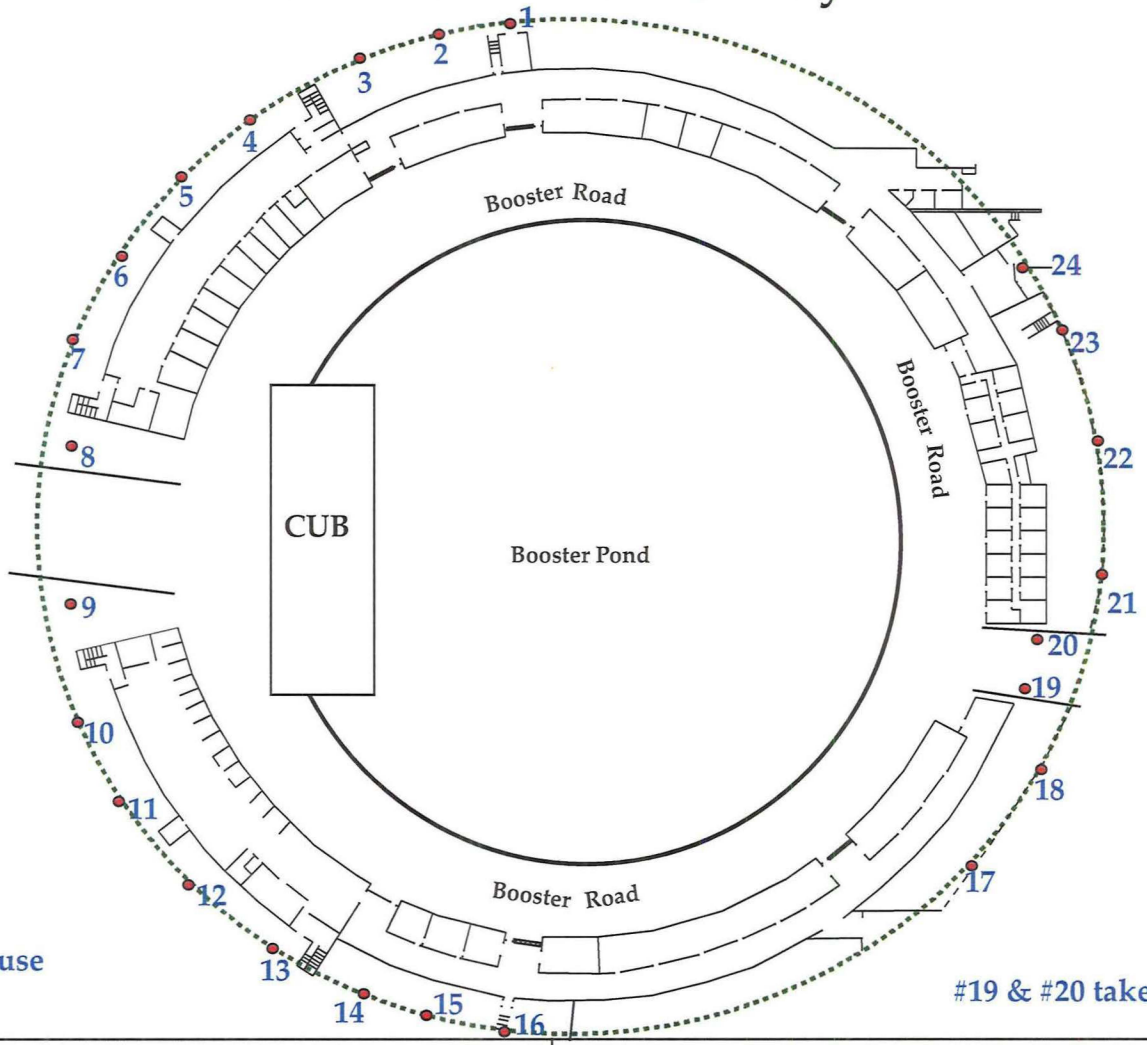
Radiation Summary L1 to S4



Fermilab
ES&H

DATE: 12/22/20	TIME: 0945	PURPOSE: Beam "ON" Survey

Booster Beam- On Survey



SURVEY POINTS

SURVEY POINT #1:	1,555
SURVEY POINT #2:	1,500
SURVEY POINT #3:	1,544
SURVEY POINT #4:	3,226
SURVEY POINT #5:	2,973
SURVEY POINT #6:	3,092
SURVEY POINT #7:	2,760
SURVEY POINT #8:	3,328
SURVEY POINT #9:	2,701
SURVEY POINT #10:	2,703
SURVEY POINT #11:	3,030
SURVEY POINT #12:	3,463

SURVEY POINTS

SURVEY POINT #13:	2,812
SURVEY POINT #14:	1,601
SURVEY POINT #15:	1,626
SURVEY POINT #16:	1,879
SURVEY POINT #17:	2,174
SURVEY POINT #18:	2,456
SURVEY POINT #19:	1,587
SURVEY POINT #20:	1,698
SURVEY POINT #21:	2,414
SURVEY POINT #22:	2,498
SURVEY POINT #23:	2,473
SURVEY POINT #24:	1,442

#8 & #9 Location of Doghouse

#19 & #20 taken on center of road asphalt

All Areas < N/A mR/hr@1foot (Unless otherwise indicated)

Highest Dose Rate Found: N/A mR/hr@1foot

Radiation Instruments Used

Inst Type:	Bicron Analyst	REM 500	
Inst No:	#35	#1	N/A
Batt/Source Chk:	Sat/Sat	Sat/Sat	
Cal. Due Date:	Oct. / 2021	Oct. / 2021	
Background:	See Map	See Map	

LEGEND

- Dose Rate in mR/hr @ 1 ft. * - Unlabeled Radioactive Material

(#R) - Radioactive Material Wipe (#) - Wipe (#F) - Floor Wipe

Bkgd _____ cpm

Wipe #	Reading		Wipe #	Reading	
		ccpm			ccpm
		ccpm			ccpm
	N/A	ccpm		N/A	ccpm
		ccpm			ccpm
		ccpm			ccpm

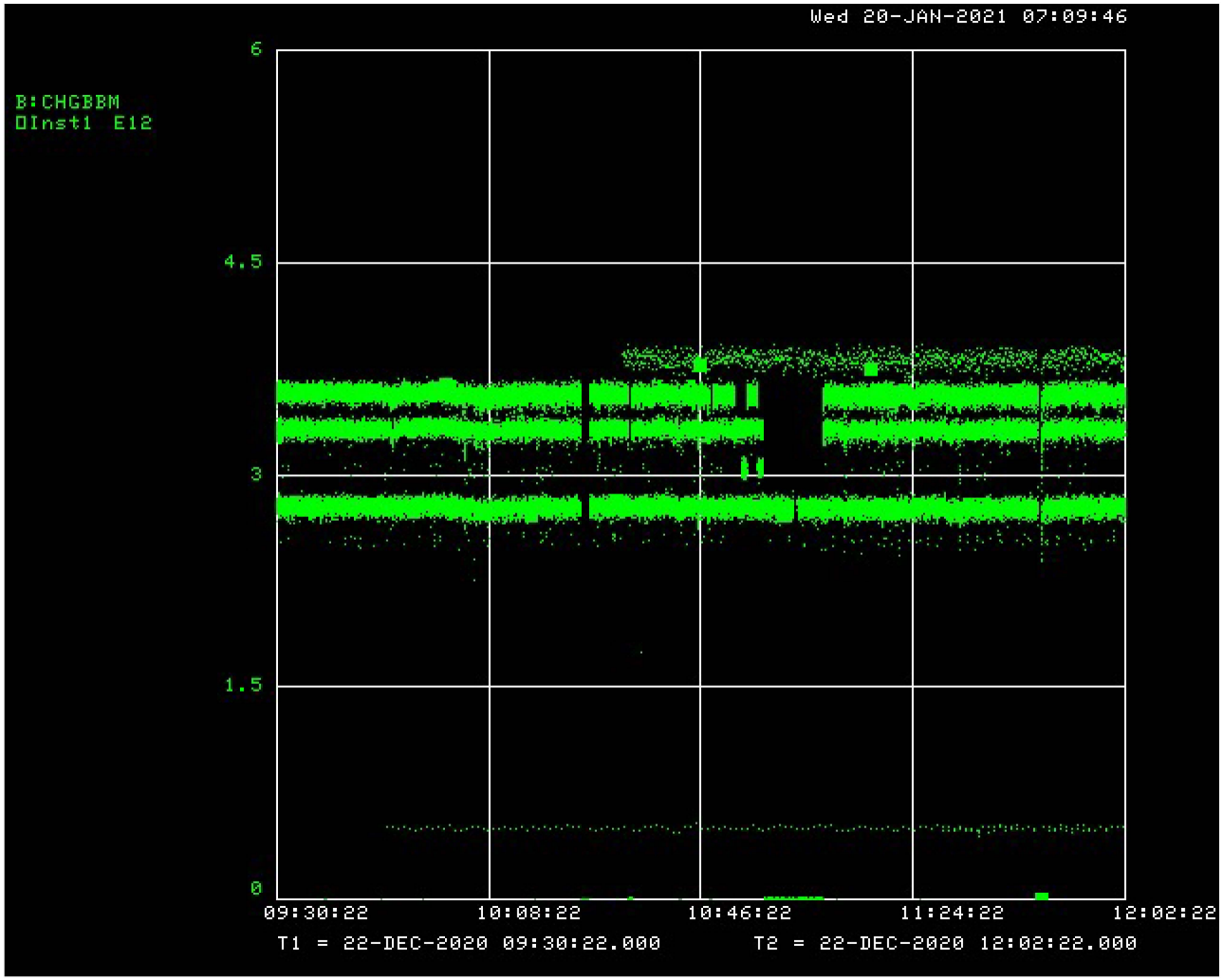
Comments:

A Beam "ON" survey was performed at the perimeter Booster ring
Beam intensity in Linac was 21 mA. Nothing was detected using the REM 500 meter.

Readings were taken at one minute integrations using the Bicron instrument scaler and 1 minute reading with the Rem 500.

Surveyed By: *Jose De La O #4175*

Reviewed By: Maddie Schoell, UID:maddiew Digitally signed by Maddie Schoell, UID:maddiew Date: 2021.01.19 16:52:21 -06'00'


Wed 20-JAN-2021 07:09:46
B:CHGBBM
DInst1 E12
6
4.5
3
1.5
0
09:30:22
10:08:22
10:46:22
11:24:22
12:02:22
T1 = 22-DEC-2020 09:30:22.000
T2 = 22-DEC-2020 12:02:22.000

Booster

Gamma Survey Results

Bicron Results

Location	Background (cpm)	Gross Beam-On (cpm)	Net Beam-On (cpm)	Standard Deviation	Net ± St. Dev.	L_C	N_D
1	1508	1555	47	55.34	47 ± 55.34	90.326	183.396
2	1207	1500	293	52.03	293 ± 52.03	80.810 !	164.360
3	1214	1544	330	52.52	330 ± 52.52	81.044 !	164.828
4	2876	3226	350	78.12	350 ± 78.12	124.740 !	252.239
5	3055	2973	-82	77.64	-82 ± 77.64	128.563	259.887
6	2747	3092	345	76.41	345 ± 76.41	121.910 !	246.578
7	2605	2760	155	73.25	155 ± 73.25	118.717 !	240.191
8	2319	3328	1009	75.15	1009 ± 75.15	112.011 !	226.776
9	2684	2701	17	73.38	17 ± 73.38	120.504	243.766
10	2535	2703	168	72.37	168 ± 72.37	117.111 !	236.979
11	2503	3030	527	74.38	527 ± 74.38	116.370 !	235.496
12	2654	3463	809	78.21	809 ± 78.21	119.829 !	242.415
13	2438	2812	374	72.46	374 ± 72.46	114.849 !	232.453
14	1588	1601	13	56.47	13 ± 56.47	92.690	188.127
15	1502	1626	124	55.93	124 ± 55.93	90.146 !	183.036
16	1799	1879	80	60.65	80 ± 60.65	98.656	200.061
17	1699	2174	475	62.23	475 ± 62.23	95.875 !	194.498
18	1687	2456	769	64.37	769 ± 64.37	95.536 !	193.819
19	1433	1587	154	54.95	154 ± 54.95	88.051 !	178.845
20	1380	1698	318	55.48	318 ± 55.48	86.407 !	175.557
21	1874	2414	540	65.48	540 ± 65.48	100.692 !	204.133
22	1996	2498	502	67.04	502 ± 67.04	103.918 !	210.586
23	1796	2473	677	65.34	677 ± 65.34	98.574 !	199.897
24	1317	1442	125	52.53	125 ± 52.53	84.412 !	171.566

Converted to mR/hr

Background (mR/hr)	Gross Beam-On (mR/hr)	Net Beam-On (mR/hr)	Standard Deviation	Net ± St. Dev.	D_D
0.008	0.008	0.000	0.0003	0 ± 0.0003	0.001
0.006	0.008	0.001	0.0003	0.001 ± 0.0003	0.001
0.006	0.008	0.002	0.0003	0.002 ± 0.0003	0.001
0.014	0.016	0.002	0.0004	0.002 ± 0.0004	0.001
0.015	0.015	0.000	0.0004	0 ± 0.0004	0.001
0.014	0.015	0.002	0.0004	0.002 ± 0.0004	0.001
0.013	0.014	0.001	0.0004	0.001 ± 0.0004	0.001
0.012	0.017	0.005	0.0004	0.005 ± 0.0004	0.001
0.013	0.014	0.000	0.0004	0 ± 0.0004	0.001
0.013	0.014	0.001	0.0004	0.001 ± 0.0004	0.001
0.013	0.015	0.003	0.0004	0.003 ± 0.0004	0.001
0.013	0.017	0.004	0.0004	0.004 ± 0.0004	0.001
0.012	0.014	0.002	0.0004	0.002 ± 0.0004	0.001
0.008	0.008	0.000	0.0003	0 ± 0.0003	0.001
0.008	0.008	0.001	0.0003	0.001 ± 0.0003	0.001
0.009	0.009	0.000	0.0003	0 ± 0.0003	0.001
0.008	0.011	0.002	0.0003	0.002 ± 0.0003	0.001
0.008	0.012	0.004	0.0003	0.004 ± 0.0003	0.001
0.007	0.008	0.001	0.0003	0.001 ± 0.0003	0.001
0.007	0.008	0.002	0.0003	0.002 ± 0.0003	0.001
0.009	0.012	0.003	0.0003	0.003 ± 0.0003	0.001
0.010	0.012	0.003	0.0003	0.003 ± 0.0003	0.001
0.009	0.012	0.003	0.0003	0.003 ± 0.0003	0.001
0.007	0.007	0.001	0.0003	0.001 ± 0.0003	0.001

Booster

Neutron Survey Results

Location	Average Background (mrem)	Average Background (mrem/hr)	Gross Beam-On (mrem/hr)	Net Beam-On (mrem/hr)	Sample Standard Deviation (mrem/hr)	Net ± St. Dev. (mrem/hr)	L_{C_N}	D_{D_N}
1	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
2	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
3	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
4	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
5	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
6	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
7	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
8	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
9	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
10	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
11	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
12	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
13	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
14	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
15	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
16	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
17	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
18	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
19	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
20	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
21	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
22	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
23	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04
24	0.01933	0.01933	0.000	0.000	1.08E-04	0 ± 0.000108	2.52E-04	5.04E-04

Booster

Scaling Dose Rates to Booster Operating Limit Intensity & Calculate Annual Dose

Intensities (protons/hr)	
Survey	Op. Limit
1.20E+17	**2.70E+17**

Beam Up-Time	
# Weeks	52
Efficiency	100%
100.0%	

	At Survey Intensity		Scaled to Operating Limit Intensity at Standard Beam Up-Time					
	Gamma	Neutron	Gamma			Neutron		
Location	**Net Beam-On (mR/hr)**	**Net Beam-On (mrem/hr)**	**Net Beam-On (mR/hr)**	**2,000 hr Working Year (mrem)**	**24/7/365 (mrem)**	**Net Beam-On (mrem/hr)**	**2,000 hr Working Year (mrem)**	**24/7/365 (mrem)**
1	0.000	0.000	0.000	0.000	0.000	0.000	0	0
2	0.001	0.000	0.002	4.500	19.710	0.000	0	0
3	0.002	0.000	0.005	9.000	39.420	0.000	0	0
4	0.002	0.000	0.005	9.000	39.420	0.000	0	0
5	0.000	0.000	0.000	0.000	0.000	0.000	0	0
6	0.002	0.000	0.005	9.000	39.420	0.000	0	0
7	0.001	0.000	0.002	4.500	19.710	0.000	0	0
8	0.005	0.000	0.011	22.500	98.550	0.000	0	0
9	0.000	0.000	0.000	0.000	0.000	0.000	0	0
10	0.001	0.000	0.002	4.500	19.710	0.000	0	0
11	0.003	0.000	0.007	13.500	59.130	0.000	0	0
12	0.004	0.000	0.009	18.000	78.840	0.000	0	0
13	0.002	0.000	0.005	9.000	39.420	0.000	0	0
14	0.000	0.000	0.000	0.000	0.000	0.000	0	0
15	0.001	0.000	0.002	4.500	19.710	0.000	0	0
16	0.000	0.000	0.000	0.000	0.000	0.000	0	0
17	0.002	0.000	0.005	9.000	39.420	0.000	0	0
18	0.004	0.000	0.009	18.000	78.840	0.000	0	0
19	0.001	0.000	0.002	4.500	19.710	0.000	0	0
20	0.002	0.000	0.005	9.000	39.420	0.000	0	0
21	0.003	0.000	0.007	13.500	59.130	0.000	0	0
22	0.003	0.000	0.007	13.500	59.130	0.000	0	0
23	0.003	0.000	0.007	13.500	59.130	0.000	0	0
24	0.001	0.000	0.002	4.500	19.710	0.000	0	0