

Memo

Date: May 13, 2015

To: RSC, D. Kayran & I. Ben-Zvi

From: D. Beavis 

Subject: Update on ERL Table of Dose Rates out Penetrations for MCIs

The following Table has been generated from Table XI of the March 28, 2008 memorandum on ERL penetrations¹. The Table was updated to include examination of the as built facility and more detailed calculation of some faults. The MCIs are conducted at a beam loss rate of 1 MW for 3.5 MeV electrons and 50 kW for 25 MeV electrons. The areas of the table that have been yellow filled are either changed or are calculations of weak areas such as seams in the shielding that were not included in the original analysis. Although some of the numbers are large and it is expected that multiple radiation monitors will detect such beam faults and turn the beam off in three seconds or less.

It has always been the philosophy that the ERL MCIs would be examined at low beam current to understand whether changes to the shielding or distribution of radiation detectors are necessary for ALARA purposes. In addition, it has been suggested in the past that the beam losses used for the MCIs are excessively high. There is now technical information² that may aid in reducing the beam loss rate used in the MCI analysis.

Maximum Penetration Dose Rates³

penetration	Max. Gamma Dose rate (mrem/hr)	
New Laser port	100,000	3.5 MeV beam [9]
1 MW Waveguide	25,000	Adjacent wall and not port
Cryo Ports (4)	8,400 [1]	2000 [1][10]
Cryo Ports (4)	40,000 10,000	3.5 MeV 25 MeV [14]
North Gate	260	1800
North Labyrinth Buss Block	4,000 [2]	100
South Gate	49,000 [3]	160

¹ See <http://www.c-ad.bnl.gov/esfd/RSC/Memos/ERL-Penetrations3.pdf>

² See http://www.c-ad.bnl.gov/esfd/RSC/Memos/5_11_15_ERL.pdf

³ If the energy is not specified it is 25 MeV.

Port in South Labyrinth (2)	60,000 [4][11]	600 [5]
West Trench	6,000	100 [5]
East Trench	2,000	1,600 [5]
South labyrinth buss block	100	300 [5]
ODH Vent	10,000 [6]	4,000 [6]
ODH Vent side shielding	100,000	3.5 MeV @ 1 MW
Lifting Fixture holes (4)	1,400 [7]	8 [7]
50 kW waveguide	28,000 [8]	1,000 [8]
Roof seam with steel—on building roof	25,000 12,800	For 3.5 MeV @ 1MW For 25 MeV @ 50kW
West shim seam	200	For 3.5 or 25 MeV [12],[13]
East shim seam	80,000 17,000	For 3.5 @ 1 MW For 25 MeV @ 50 kW[13]
North end seam	1000 175	For 3.5 MeV @ 1 MW For 25 MeV @ 50kW

Comments:

- [1] Assumes that steel has been used to reduce the gamma rays by a factor of 10.
- [2] This is directly outside the buss block. This may be in a fenced area.
- [3] A shield block in the ring center would substantially reduce this number, if desired.
- [4] At port exit which may be in a fenced area. Port may be packed in the future. This value is for the port with the highest dose rate of the two ports.
- [5] Not presented in text.
- [6] This is on the roof and is not allowed to have personnel.
- [7] Evaluated at the edge of the shielding and not on the roof.
- [8] The penetrations for the cables ports, water pipes and the 50 kW waveguide are presented in another note (see reference 10). The dose rates presented here are at a height of 12 feet above the floor.
- [9] The dose rate from the 25 MeV beam bouncing off the floor from the south arc has been crudely calculated to be less. This is for 1 MW of 3.5 MeV electrons.
- [10] Number of ports has changed from five to four.
- [11] This was the penetration of two that was considered the worst. It is now filled with concrete so a lower number is expected.
- [12] Takes credit for the two foot light concrete cap blocks that were added.
- [13] Does not take credit for the steel shim which will reduce the number more.
- [14] MCNPX was used for the as built configuration. The 25 MeV result is for the beam line 6 m from the wall, which provides a shallower angle for penetrating the opening.