

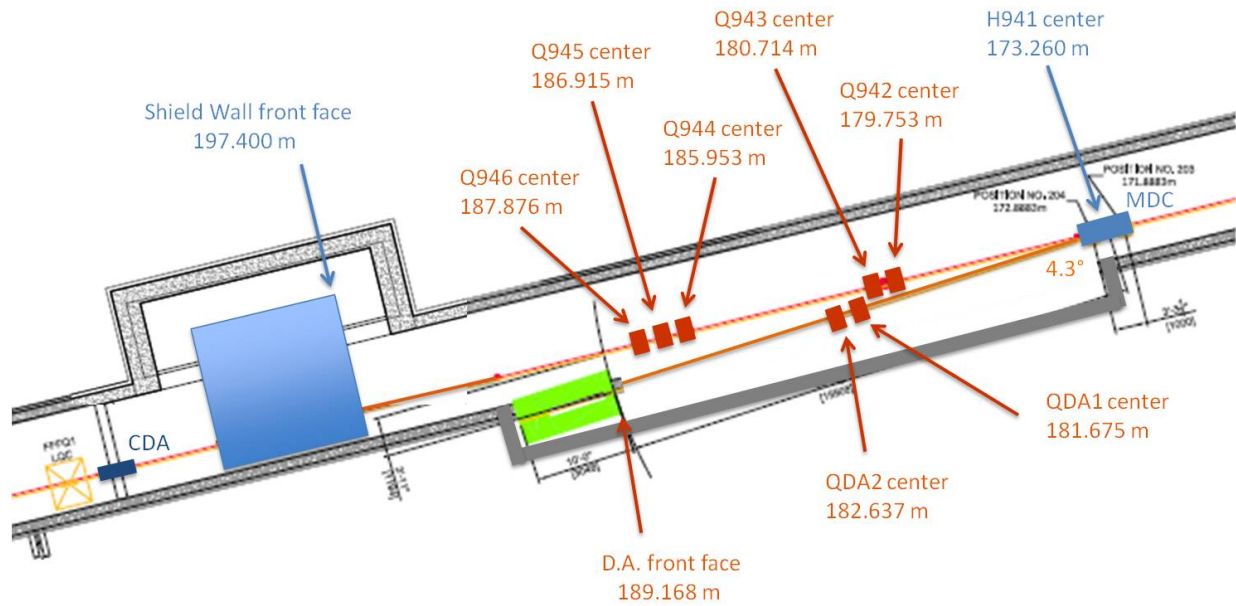
In-tunnel shield wall for the M4 Beam Line – readme file

September 5, 2013

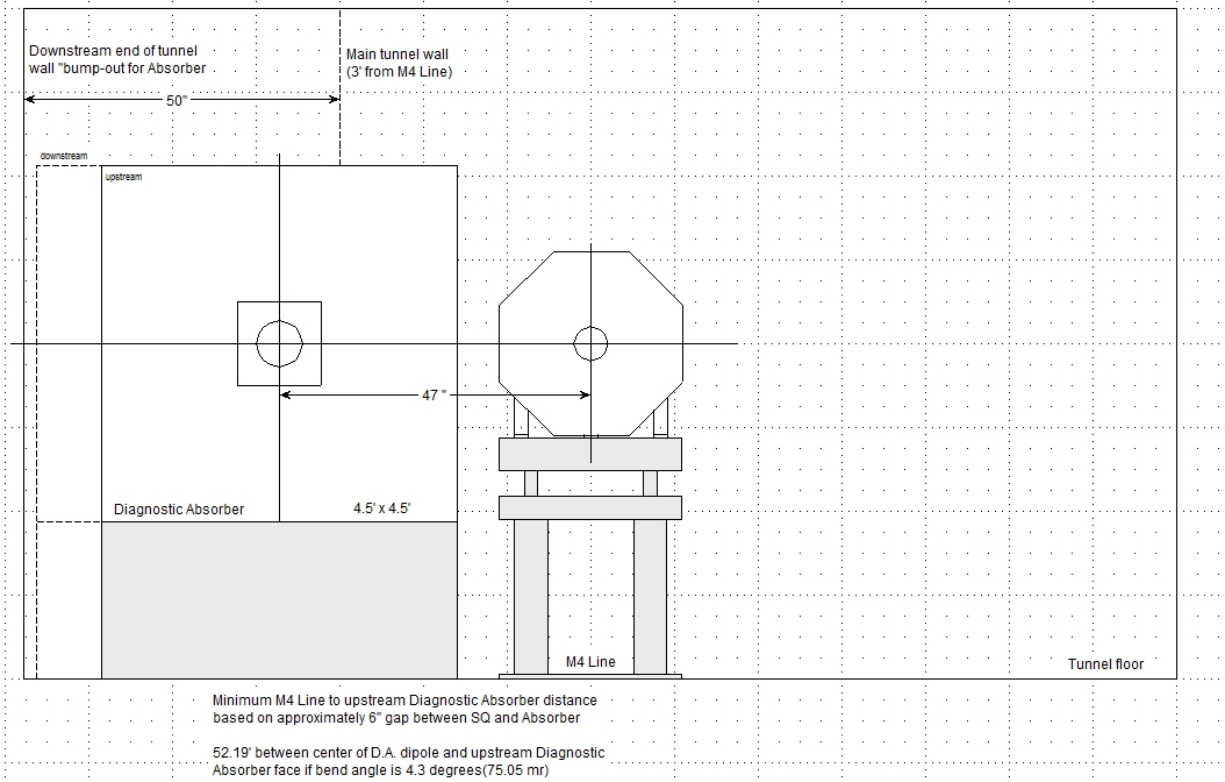
T. Leveling

The M4 line requires a shield wall to all personnel to access the DS M4 line during beam operation to the diagnostic absorber. A layout of the proposed shield wall is shown in the following figure.

Proposed shield wall



An elevation view of the face of the beam dump is shown in the following image.



One can see some inconsistencies between and within the sketches which must be resolved before making the model for a MARS simulation. In the first figure, beam misses the center of the absorber. In the second, and not consistent with the first, the back end of the dump extends into the beam enclosure aisle.

I'll start with a new directory in /grid/cdpers for the m4shieldwall and leave the original dump files intact.

9/6/13

Had further discussions with Jim. The bend angle can be 5 degrees, but the placement of components should go as in the first figure. I have the dump, shield wall, and enclosure modeled. The GEOM.INP file is included as an attachment and will be modified as I progress. Next, I'll add the 7 SQAs to the model.

Main quads are in. Now have to add dump line quads which is going to take some doing. The transform calculations will be somewhat extensive.

9/7/13

The dump line quads were moved fairly easily just by adjusting the xyz coordinates of the transform. Also included the MDC magnet and created a B field. Remember to define the B field region, one just needs to identify the volume number. Use the INDX switch 4=T or F to turn on and off the B field which

allows beam to go straight ahead or to the dump. Did some tuning of the B field strength to clean transmission to the dump. Rotated MDC 1.125 degrees to optimize aperture.

Added a labyrinth exit detector, shield wall detector, TLM, and main beam pipe detector to the model. Have some preliminary runs with CTRL 0 3=1 to calculate volumes. Some fine tuning of volumes is still required.

Volumes have been calculated and m1512.f is up to date. Added a surface crossing detector for mfill at the entrance to the labyrinth.

Running a 50000 ip job just to check things out before launching a job on the grid. Still need to make histogram input file. Didn't complete. Forgot to fix the histogram files which were inane relative to this model. XYZHIS.INP now has completed. A 1000 ip job completed successfully. Nothing shows up in the labyrinth and shield wall detectors. I'm adding a second surface for the shield wall and creating a second fort.# file to get the direct through the shield wall. So there will be several runs required following the initial run. Runs and purposes are:

1. Get TLM response and 2 surface crossing files for normal, clean running to diagnostic dump. – **Done!**
2. Get DET through labyrinth. Requires stage 2 run with fort.71 file. **Done!**
3. Get DET through shield wall. Requires stage 2 run with fort.72 file. **Done!**
4. Run 138 watt beam into MDC to get TLM response for the typical loss limit to compare TLM response in 1.

1000 ip yields for fort 71 and fort 72 are 333 and 64647, respectively and just about a factor of 200x. **(This was due to a coding error, described below).**

Next, run a test-queue job with 10,000 ip jobs and determine run times for the respective files. A single test queue job should result in a sufficient fort 72 file required for run 3. It should also answer the question about the TLM response.

Launched a 10,000 ip job on the grid. xsdir was read protected and that one failed. Relaunched another one and it's running.

BTW, vars is set to 1.33E11 or 170 watts.

Yields from fort files are:

Fort.71 for labyrinth – STACK 3,500; PRIME 10,000

Fort.72 for shield wall – STACK 581,507; PRIME 10,000 (**NOTE: this was based upon an error in mfill; see below**)

First job is to analyze MTUPLE.EXG to look at TLM response for normal running. Errors are too large for the 10,000 ip run. More IP are required. I'll remove the fort72 from mfill since that file is sufficient and

rerun for TLM statistics and to get more lines for the labyrinth particle file. Run time for 10,000 ip was 7,351 seconds.

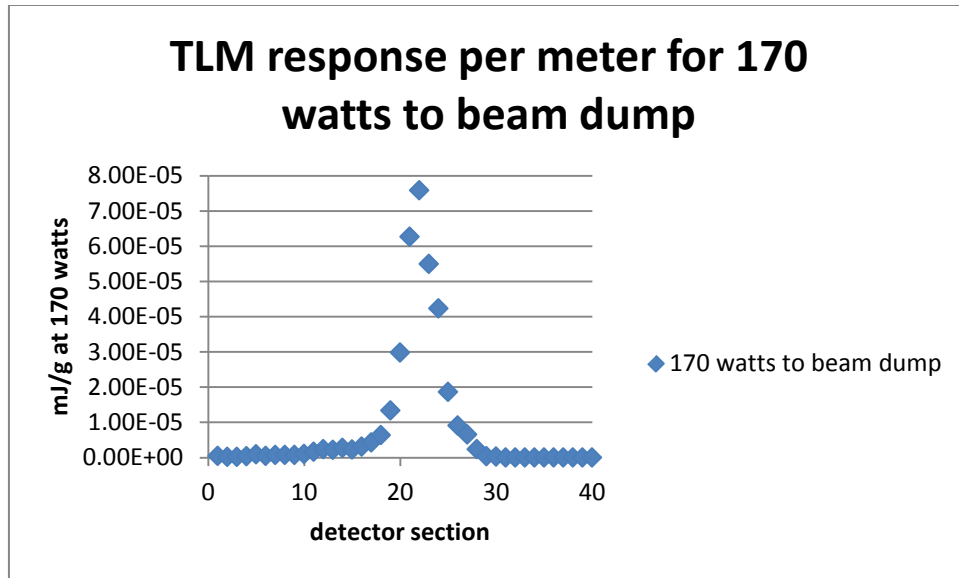
Launched 500 jobs with 5000 ip at 2030. Took the fort 72 code out of m1512.f and recompiled. Placed the fort.72 file in m4wall/local/wall_input for input to the shield wall calculation to be made later.

Here is the echo from the launch:

```
<mu2egpvm02.fnal.gov> /grid/fermiapp/mu2e/users/gandr/dev/mu2egrid/bin/mu2emars --input MARSBASE.INP --executable=./rmars-mcnp-linux --setup=setupdat.sh --verbose --njobs=500
Using: MU2EGRID_VERSION => v1_00_07
Using: MU2EGRID_DIR => /grid/fermiapp/products/mu2e/artexternals/mu2egrid/v1_00_07
Using: MU2EGRID_PRESTAGE =>
Using: MU2EGRID_OUTSTAGE => /grid/data/marsmu2e/outstage
Using: MU2EGRID_SETUP => /grid/fermiapp/mu2e/personal/leveling/m4wall/setupdat.sh
Using: MU2EGRID_MASTERINPUT => /grid/fermiapp/mu2e/personal/leveling/m4wall/MARSBASE.INP
Using: MU2EGRID_GFTPSERVER => gsiftp://if-gridftp-marsmu2e.fnal.gov
Using: MU2EGRID_EXECUTABLE => /grid/fermiapp/mu2e/personal/leveling/m4wall/rmars-mcnp-linux
Using: MU2EGRID_OUTDIRFMT => %d/run_%03d
Using: MU2EGRID_TOPDIR => /grid/fermiapp/mu2e/personal/leveling/m4wall
Using: MU2EGRID_SUBMITTER => leveling
Command: jobsub --grid --mail_never -N 500 --opportunistic -e MU2EGRID_VERSION -e MU2EGRID_DIR -e MU2EGRID_PRESTAGE -e MU2EGRID_OUTSTAGE -e MU2EGRID_SETUP -e MU2EGRID_MASTERINPUT -e MU2EGRID_GFTPSERVER -e MU2EGRID_EXECUTABLE -e MU2EGRID_OUTDIRFMT -e MU2EGRID_TOPDIR -e MU2EGRID_SUBMITTER /grid/fermiapp/mu2e/personal/gandr/dev/mu2egrid/bin/impl/mu2emars.sh
Submitting...
/mu2e/data/users/condor-tmp/leveling/mu2emars.sh_20130907_204112_27474_0_1.cmd
current jobsub is jobsub v1_2d
'test' release is jobsub v1_2f, --site A,B,C sends to site A or B or C
Please report any problems to the service desk or ifront-computing@fnal.gov

submitting...
Mu2e external products are rooted at: /grid/fermiapp/products/mu2e
MU2E_DATA_PATH is: /grid/fermiapp/mu2e/DataFiles
bashrc
Submitting job(s).....
.....
.....
.....
.....
.....
.....
.....
.....
500 job(s) submitted to cluster 11155342.
```

All 500 jobs finished up in about 75 minutes; all done at 2258. Concatenated fort.71 files resulting in 897,437 lines from 2.5E6 incident particles. Used r_average to combine output files. TLMMTUPLE.EXG data is moved to an excel spreadsheet. Here is the result:



9/9/13

So problem 1 is now complete. Moving on to problem 2. Requirements are:

- a) INDX 4=F - done
- b) Comment out mfill routine - done
- c) Open fort.71 (it has an alias now) - done
- d) Modify subroutine BEG1; refer to STACK (897437) and PRIME (2.5D6)above - done
- e) Make certain the x, y, z, DCX, DCY, DCZ values are NOT transposed. (check mfill and make sure BEG1 read statements are consistent) – done & done – good catch!
- f) Create OPEN statement - done
- g) Create STAGEFILE - done
- h) Delete *.o and recompile – done
- i) Test run and check particle tracks - done
- j) Make trial run and determine IP and run time – calculate grid submission parameters - done

1E6 particle trial run took 189 seconds. 20E6 ip should require about 2 hours runtime. Errors in the labyrinth detector are on the order of 100% from an examination of ED in MTUPLE.EXG. However, the errors are more like 30% in mars.hbook. 500 jobs of 20E6 should make the errors rather tiny and the job won't take that long to run.

Submitted 500 jobs (11170419) with 20E6 ip each at 0818. All 500 were running by 0845 and were finished by 0930.

Created a fair number of pdf files of GUI images for the model.

For labyrinth detector post processing:

- i. Create file structure in m4wall/output to distinguish output files from various runs. - done
- ii. Use r_average to combine MTUPLE.EXG and mars.hbook results – done

Peak rates are:

Total (DET) – 37 mrem/hr

Neutron (DEN) – 30 mrem/hr

Gamma (DEG) – 1.2 mrem/hr

Muon (DEM) – 0.2 mrem/hr

Errors are about 1%. The DET GUI result has been printed and normalized to 170 watts with results in mrem/hr. This completes problem #2. Moving on to problem #3. Requirements are:

- a) Change the source name in m1512.f and in stagefile. - done
- b) Change STACK and PRIME - done
- c) rm *.o and recompile - done
- d) check tracks in small trial run
- k) Test run and check particle tracks; make GUI of tracks
- e) Make trial run and determine IP and run time – calculate grid submission parameters

I was getting some errors in the trial runs and tracked it down to an error in the mfill subroutine which created the fort.72 file. So, I have to set up problem 1 again and make another fort 72 file. I needed to do this anyway for problem #4, but it's not a convenient time for that. The error was in the if statement for the z position:

```
if(z2 .gt. 2740.0 .and. y1 .lt. 2740.D0) then
    should have read:
if(z2 .gt. 2740.0 .and. z1 .lt. 2740.D0) then
```

This explains the anomaly in the creation of the fort71 and fort72 files reported above.

To proceed:

- i. Reactivate MARS.INP cards for 8 GeV energy and position - done
- ii. Turn on magnetic field - done
- iii. Comment out the open statement - done
- iv. Comment out the subroutine beg1 statements - done
- v. Restore corrected mfill statements for fort.72 - done
- vi. rm *.o - done
- vii. recompile and test run 10 ip; check tracks. 10 IP results in 913 lines in the fort.72 file. For this run, I will remove the neutron energy cut to get more energetic neutrons incident on the wall. Low energy neutrons are not useful for this run, but where necessary for the labyrinth job. After removing the low energy threshold, 1000 IP yields 1121 lines for fort.72. - done

- viii. do trial run to determine grid submission parameters; for 1000 ip, 689 lines were created on the grid. Hmmm . . . mars.log file shows normal exit with no warnings. Run time was 237 seconds. To get 5E5 lines, roughly 750,000 ip are required. The required run time is 50 hours. 50 jobs or 1 hr run time per job with 15,000 ip should yield 5E5 lines.- done
- ix. submit job – done at 1410.

Got STACK = 630717 for PRIME=750,000

To submit the stage 2 job for the shield wall:

- 1) concatenate 50 fort 72 files. Rename them and move to local/wall_input - done
- 2) turn off magnetic field – done
- 3) **TURN OFF BEAM PARAMETERS**
- 4) turn on neutron low energy cut - done
- 5) in m1512.f
 - a) make open statement - done
 - b) comment out mfill - done
 - c) uncomment beg1 (STACK, PRIME, etc.) - done
- 6) rm *.o - done
- 7) recompile and short test run with tracks. Make *.pdf of track file - done
- 8) determine grid run time parameters for 12 foot shield wall detector – launched at 1607.

The job exited with status 0 but there was an error message in the mars.log file:

```
Projectile # 1 : JJ,ZCHAR,W,E,TOFF =      9  0.  1.28E+00  1.372E-03  0.000E+00
X,Y,Z,DX,DY,DZ =  1.81E+00  3.80E+01  2.74E+03 -2.159490E-01 -1.930000E-01  9.571400E-01
Projectile # 2 : JJ,ZCHAR,W,E,TOFF =      9  0.  1.28E+00  1.372E-03  0.000E+00
X,Y,Z,DX,DY,DZ =  1.25E+00  3.75E+01  2.74E+03 -2.159490E-01 -1.930000E-01  9.571400E-01
Projectile # 3 : JJ,ZCHAR,W,E,TOFF =      9  0.  1.28E+00  1.233E-03  0.000E+00
X,Y,Z,DX,DY,DZ =  1.04E+00  3.79E+01  2.75E+03 -4.255039E-02  6.714278E-02  9.968356E-01
First source particle has abnormally small energy or weight: NI,JJ,E,W=      5581
7007  0.0000000000000000      1.0930830183600000
76.69user 0.23system 1:19.55elapsed 96%CPU (0avgtext+0avgdata 674816maxresident)k
0inputs+0outputs (53major+42190minor)pagefaults 0swaps
mu2egrid exit status 0
```

Note that the particle type is 7007. Also found some 6006 and 3004 lines in the fort.72 file. For now, I just went through manually and removed them. I'm wondering if this is some kind of recoil nucleus or something, one of the new features in MARS. I'll have to ask Nikolai. Relunched the trial job at 1625. It took 114 seconds to run and there were no errors. A 2 hour job could be done with 318,584 IP. I'll just make it 325,000 and launch 500 jobs. This would give a total of 1.625E8 ip.

- 9) submit job – done at 1641; job number is 11187167. It crashed. More things like 3003 in jj field of fort.72. I've recompiled with a new number of lines and restarted the job with nevt = number of lines in wall_input to find the next place it crashes. The problem is that nuclei and some particles are written to the file with the energy=0.000000E+00. I have eliminated those. Nikolai said that it's nothing new that nuclei are produced. For future work, it will be wise to check the energy to make sure it's not 0 before writing the line to file. The job has now run for 20 minutes, double the

previous run time. I'm changing NEVT to 325,000 and launching 500 jobs. DO NOT USE the single job with 630285 IP! Launched 11187742 at 2145.

9/10/13

The trial job with 630285 IP finished without errors. One can assume the 500 jobs should be good as well. 500 jobs from 11187748 were processed and files are located at m4wall/output/shield_det_run.

Printed shield wall detector and labyrinth wall detector results from the shield wall run. Also, made a flux total plan view from the dump run to direct our thinking on design changes.

NOTE: I ran the problem #3 job once again because I didn't comment out the Beam Energy and position cards before running the job. The new answer is just the same as the previous one, so there was no impact on the job.

This completes work on problem #3. Moving on to problem #4.

Requirements are:

- I. magnetic field on - done
- II. move incident beam close to left of beam channel to steer into MDC magnet – done, moved it -5 cm.
- III. comment out subroutine beg1 - done
- IV. comment out open statement - done
- V. turn on beam parameters cards - done
- VI. flux histograms required; keep shield wall and labyrinth just in case. - done
- VII. make test run; get track gui - done
- VIII. short run is all that should be required
- IX. set VARS 4=1.0870E11

Job was launched at 1345 with 50,000 ip.

9/11/13

The job 11195676 required 10 hours to complete. This is suspicious for just 50,000 ip. OK, what's wrong with this picture?

ENRG 5=1.E-12

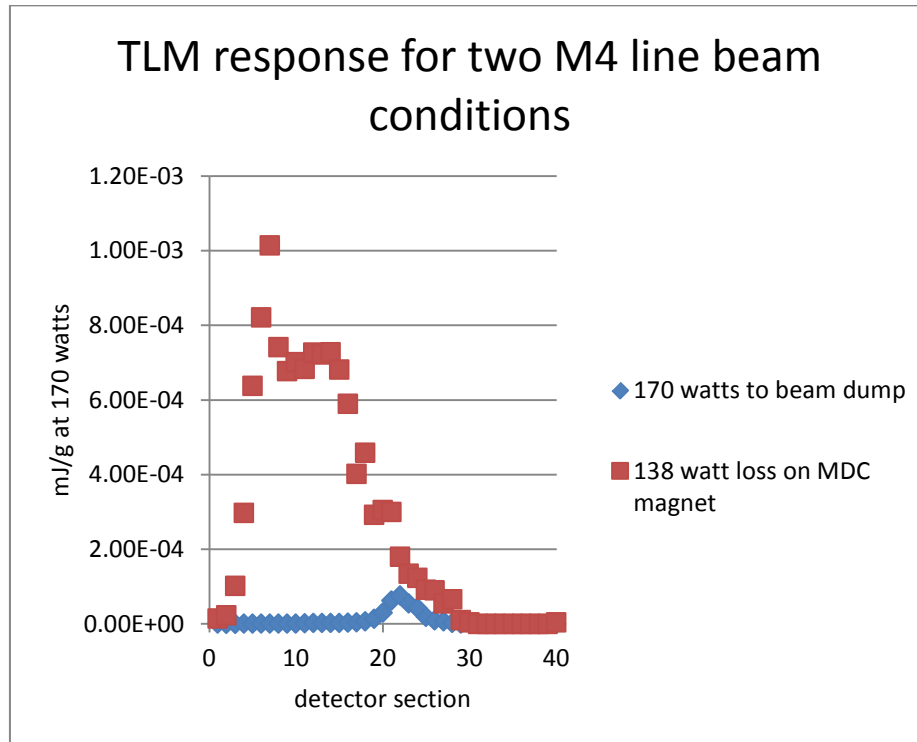
ENRG 8

This error was not identified in the MARS syntax check. I will rerun the job with the following substitution:

ENRG 8.0 5=1.E-12

Hmmm . . . from a check of the MARS.OUT file, it looks like the job ran correctly in spite of this format problem. Perhaps this is one of the "improvements"?

Here is the comparison of 170 watts to DA and 138 watt loss on MDC:



The TLM response for normal running to the dump is 3% of the tolerable loss (138 watts).

This completes the work on problem #4.

9/12/13

Presented findings for problems 1-4 to department this date. Three new problems require a solution:

5. The efficacy of the shield wall cannot be determined because of the labyrinth leakage. Redo problem #3 with a solid shield wall and no labyrinth. Move the shield wall detector DS 25' just in case distance is helpful.
6. If shield wall is insufficient, add 18" US and DS of existing wall and rerun job without labyrinth.
7. Redesign labyrinth with longer legs.
8. Better start including main vacuum detector results in all future work. Also, change vacuum to beam pipe, 4" diameter, 0.065" pipe wall of stainless steel.

Problem 5:

- a) changed shield wall width to 10'
- b) moved shield wall detector 25' DS to keep it within the model
- c) changed labyrinth detector to GTIL
- d) changed air of labyrinth bump to GTIL
- e) changed surface for shield wall to +/- 5 feet wide

- f) put beam back to $y = -60.96$ cm
- g) removed low energy cutoff for neutrons for stage 1 run
- h) create new VOLMC.NON to get new shield wall volume and bump volume. Just commented out the old values and replaced with new ones so I can revert when required.
- i) `rm *.o`
- j) recompile
- k) run with tracks
- l) do trial run

Launched job from the command line with 1000 ip to estimate secondary yield. Result is 520 lines.

Submitted a 10,000 ip job to the grid. 5424 lines were produced in 2,549 seconds. To get $5E5$ lines, requires 921,829 IP and would take 65 hours of run time. To limit run time to 2 hours requires about 33 jobs with 28,000 ip each. Launched just such a job at 1522 (11216643).

All 33 jobs finished by 1747. Concatenated the 33 files. 618,850 lines produced in 924,000 IP. Want to use at least 618,850 lines per run in stage 2.

For stage 2:

- a) in subroutine beg1, read statement
- b) turn off magnetic field - done
- c) **TURN OFF BEAM PARAMETERS - done**
- d) turn on neutron low energy cut - done
- e) in m1512.f
 - a. need an OPEN statement in m1512.f with file name local/NO_labyrinth_input - done
 - b. comment out mfill - done
 - c. uncomment beg1 (STACK, PRIME, etc.) - done
- f) `rm *.o`
- g) recompile and short test run with tracks. Make *.pdf of track file – done and printed
- h) determine grid run time parameters for 618850 ip. – done

The job finished up in 4877 seconds. To get a 2 hour run, 920,000 ip are required. I'll launch 500 jobs 2x with 920,000 ip.

At 2018, launched 11222199 and 11222200, each with 500 jobs. These may be done before midnight, but I won't look at them until Monday morning, September 16.

9/16/13

The jobs finished up but not until during the morning on 9/13. *.pdf images have been added to the PPT. Results are:

1. shield wall dose rate average is 20 mrem/hr

2. errors are <20%
3. The main vacuum result is 169 mrem/hr.

Moving on to problem #6:

- a. Extend shield wall 3 feet - done
- b. Leave everything else alone to just get effectiveness of concrete shield.
- c. Move the main detector downstream as well - done
- d. Run CTRL 0 3=1 to obtain new volumes for enclosure air and the shield - done
- e. Histograms should be OK
- f. Rm *.o
- g. Recompile
- h. Resubmitted at 1235. This time, submitted 1500 jobs since the shield wall is now three feet thicker.

Job numbers are 11252917, 11252919, and 11252920.

9/17/13

1460 jobs were held overnight. I cancelled the remaining jobs and just resubmitted this morning. 11270365 and 11275385 have been submitted so far. A third batch of 500 will be submitted a little later when the total jobs drop below 500 - done at 1617, job number 11279042.

9/18/13

Last night 502 jobs began to be held. They are still being held at this time. I submitted a ticket to ask about how to proceed on advice from Rob. While I'm waiting, processing jobs from 11270365 (500) and 11275385 (497). 11279042 has no files in it. Weighting factors are:

11270365 - 0.501505

11275385 – 498495

Help desk found an error in my kerbtempfile.txt. Corrected the file, obtained new proxy, and did "condor_release leveling" to get the jobs running again.

9/19/13

Both jobs listed above finished up, so now there are three sets of 500 job output files. Reran r_average on the last 2, recombined all three jobs with equal weighting factors, and made new output files and gui images for problem 6. The PPT has been updated with latest figures. Moving on the Problem 7 which is 15 foot shield wall with extended tunnel model. The labyrinth will be problem 8.

9/22/13

Per the drawing provided by Tomski and per dimensions provided by Jim, extended the model DS of the shield wall to the end of the enclosure. Jim provided the following dimensions: ledge at 222.8 m and end of tunnel at 236.0 m. Drawing used for tunnel dimensions is the one included in the PPT associated with this work. Next, need to run in volume calculation mode to get new volumes, and then simply rerun the problem 6 job input file. I imagine many more IP will be required and perhaps the air step length should be adjusted. Should there be a stage 3 for this problem? Stage 2 seemed to be fine for problem 6. Statistics could be harder though since the tunnel is extended considerably. I'll first just try a stage 2 run. The labyrinth detector has a lot of volumes no longer needed for the problem, so I'm commenting out that detector in GEOM.INP and the wall bump for the shield wall beforehand. Need to rm *.o and recompile! Done. Launched a test-queue job with 100,000 ip at 0853. Job finished in about 15 minutes. Found the XYZHIS.INP file needed to be adjusted – forgot to do that one. Have resubmitted a test-queue job at 0942 for this. OK, that looks better. Removed the star density histogram from the slab and added an elevation view FTL to inform how the flux looks longitudinally along z in an 8 foot wide (in y) slab. Launched another test queue job at 1012. This completed and now there is an elevation view of flux in the extended model printed to *.pdf. By 1120, launched 2000 jobs. 1,000,000 ip per job.

Jobs are about finished at 1652. Processing output files with r_average. The statistics according to MTUPLE.EXG average 47.5%. I'll launch another set of 2000 jobs. Done it at 1753. Launched at third set of 2000 jobs at 2258 – now a total of 6000 jobs of 1,000,000 ip. The listing for the 12 jobs including job numbers is:

```
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 23 06:31 11347881
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 23 06:04 11347876
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 23 03:41 11347861
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 23 03:17 11347845
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 22 23:32 11343047
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 22 22:33 11343046
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 22 22:18 11343044
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 22 21:54 11343045
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 22 16:52 11342888
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 22 16:11 11342887
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 22 15:36 11342886
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 22 15:21 11342885
```

9/24/13

Problem #7 results are reported in the PPT. Now moving on to problem #8 which is now defined to move the dump downstream attempting to take advantage of the shield wall without shining down the m4 enclosure. Using excel spreadsheet to refigure dump positions. Also will add ss beam tube to the model for both the dump line and the main line. Need to run rmars-bnab-linux first to get composition for the m8 card. The SS tube is 4" OD, 0.065" wall thickness.

MARS doesn't like STST, so I just used Fe for the beam tubes. The dump is position on the 5 degree bend ray and I positioned the dump such that a 70 degree ray emanating from the front face of the dump core intersects the beam left corner of the shield wall. Had to reinstate 8 GeV beam energy,

MDC magnetic field, and turn off stage 2 functions. Still need to consider and calculate selected model volumes.

Volumes are calculated. Preliminary runs looks promising. I've launched a 100 job, 10,000 ip run to get flux picture in plan view. If the shower appears well contained with 1E6 particle run, I've prepared subroutine mfill to catch particles leaving the DS surface of the shield wall and from the beam left tunnel wall DS of the shield wall. Here is the mfill subroutine:

```
      if(ihtyp.eq.2) then
      if((jj .ge. 18) .and. (jj .le. 21)) return
      if((jj .ne. 2).and.(jj .ne. 9)).and.(E1 .lt. 0.01)) return
      if((E2 .eq. 0.D0) .or.(E1 .eq. 0.D0)) return ! check for dead particles
         if z2 .ge. 3197.2D0 then
         if z1 .lt. 3197.2D0 then
         write(71,100)JJ,E2,W,X2,Y2,Z2,DCX,DCY,DCZ !DS shield wall surface
         return
         end if

         if(y2 .ge. -152.4D0 .and. y1 .lt. -152.4D0) then
         write(71,100)JJ,E2,W,X2,Y2,Z2,DCX,DCY,DCZ !beam left tunnel wall
         end if
         end if

100  format(1i7,8(1pe13.5))
      end if
```

The flux picture looks pretty good, but there is nothing qualitative about it in terms of dose rate. I'll run a test-queue job to determine number of particles required for a stage 1 run. 1000 ip finished in 715 seconds with a yield of 30 lines. To get 5E5 lines in a fort.71 file, need 16.67E6 ip. The total run time would be 3,310 hours. 1500 jobs should do the trick and will take about 2.2 hours each. About 11,000 ip per job should yield about the 5E5 target lines. The 1500 jobs were launched at 1734.

9/25/13

At 0610, 44 jobs remain, but it isn't clear they are still in the game. No jobs have completed since 0232 this morning and those remaining in queue are approaching 5 hours of run time. The directory for 11381975 says there are 502 subdirectories, typically an indication that jobs are completed. OK, the return from condor_q leveling is not fresh. All 1500 jobs are complete by inspection of the directories.

So there are several immediate tasks:

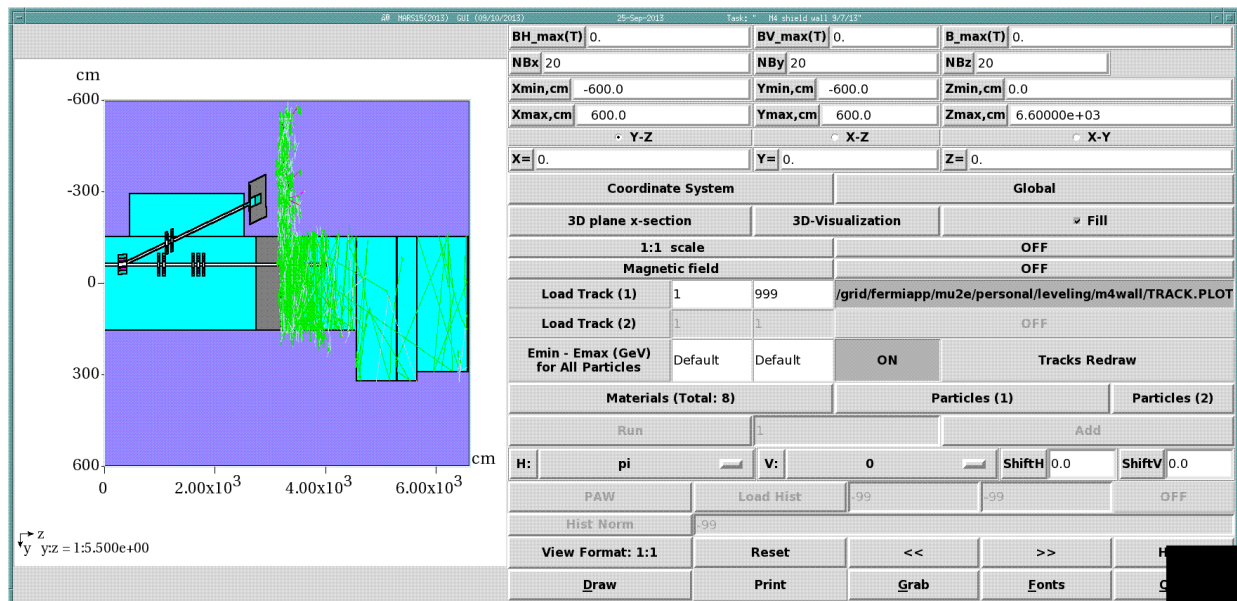
1. Run r_average on the three job sets.
 - a. Make a new flux plot
 - b. Determine dose rate at end of tunnel
 - c. Check detector wall statistics
 - d. If statistics are poor (expected), set up to run stage 2.

Did all that; flux picture is very good. Statistics are extremely poor. There was a peak rate of 14 mrem/hr, but have to run stage 2 to get a better answer. To set up stage 2:

1. Concatenate the 1500 output files, create file names and put file in directory - done

2. Set prime (1.65E7) and stack values (311775) - done
3. Comment out mfill - done
4. Setup subroutine beg1 - done
5. Edit stagefile - done
6. Turn off magnetic fields - done
7. Create open statement – done
8. Turn off MARS.INP beam parameters – done
9. rm *.o - done
10. Recompile – done
11. Trial run with TAPE 18 – done & tilt!

The reason for the tilt is shown here.



I should put another cut on the surface detector shield wall to eliminate wasted tracks not produced inside the tunnel. Need to back out of m1512.f and MARS.INP changes and rerun stage 1. Also need to re-determine number of ip, number of jobs, and run time. OK Ctrl z helps to quickly back out of file changes. Launched a new stage 1 job with the new mfill routine:

```

if(ihtyp.eq.2) then
  if((jj .ge. 18) .and. (jj .le. 21)) return
  if(((jj .ne. 2).and.(jj .ne. 9)).and.(E1 .lt. 0.01)) return
  if((E2 .eq. 0.D0) .or.(E1 .eq. 0.D0)) return ! check for dead particles
    if (z2 .ge. 3197.2D0) then
      if (z1 .lt. 3197.2D0 .and. y2 .ge. -152.4D0) then
        write(71,100)JJ,E2,W,X2,Y2,Z2,DCX,DCY,DCZ !DS shield wall surface
        return
      end if
      if(y2 .ge. -152.4D0 .and. y1 .lt. -152.4D0) then
        write(71,100)JJ,E2,W,X2,Y2,Z2,DCX,DCY,DCZ !beam left tunnel
      end if
    end if
  end if
100 format (1i7,8(1pe13.5))

```

RETURN
END

The job is still running at 1514 with an elapsed time of nearly 5 hours. One might expect just 300 lines from this. Probably will need a really big number of jobs with relatively small ip. Still going at 1745. Still going at 1920. OK, should have known – 1000 ip in 14 minutes means 100000 in one day.

9/26/13

The job finally finished at about 0600 this morning. I've made a job calculator to help with future jobs. Duh!

desired # of lines (STACK)	desired run time (seconds)	Trial IP	trial run time (seconds)	achieved # of lines	required IP (PRIME)	required njobs	IP per job
2.00E+05	18000	1.00E+05	69723	347	57636888	2233	25816
				actuals		2500	23055

Submitted 2500 jobs at 0618. Today is a gpsn01 maintenance day, so I don't know how things will behave. By 0637, nearly 1000 jobs are running. Only 746 left at 1146.

I did add the 1500 job FTL image to the PPT, so that is one useful outcome of the first stage 1 job.

So once again, need to do the following:

1. Concatenate the 2500 output files, create file names and put file in directory – concatenated 3 of the 5 sets of jobs and only come up with 180,000 IP. I've just launched a sixth set of 500 jobs to get over 200,000 for a total of 3000 jobs. - done
2. ADD PROMPT DOSE RATE to the XYZHIS.INP for the plan view along with the FTL; so DET, DEN, DEG, and DEM are all necessary for the stage 2 run. This will give an idea on where additional shielding might be useful. - done
3. Set prime (69164265) and stack values (217375) - done
4. Comment out mfill - done
5. Setup subroutine beg1 - done
6. Edit stagefile - done
7. Turn off magnetic fields - done
8. Create open statement – done
9. Turn off MARS.INP beam parameters – done

10. rm *.o - done
11. Recompile – done

Trial run with TAPE 18 – done and gui has been printed

Here is status of 6 of 6 jobs launched for stage 1.

```
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 26 18:10 11400674
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 26 13:51 11395923
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 26 12:50 11395922
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 26 12:22 11395921
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 26 11:49 11395920
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 26 11:36 11395919
```

Launched a test queue job with 100000 ip at 2105 and it's running.

After some messing around, got 4,000 jobs launched with 1,250,000 ip for a total of 5E9 ip at 2234.

9/27/13

Here is the status of the 4000 jobs launched last night (all done) red means processed:

```
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 27 07:28 11411644
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 27 07:14 11411643
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 27 06:53 11411642
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 27 06:03 11411641
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 27 05:09 11411640
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 27 04:38 11411639
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 27 04:23 11411638
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 27 03:37 11410634
```

MTUPLE.EXG and mars.hbook have been processed and are stored at:

/grid/fermiapp/mu2e/users/leveling/m4wall/output/ds_dump_position/stage_2_output

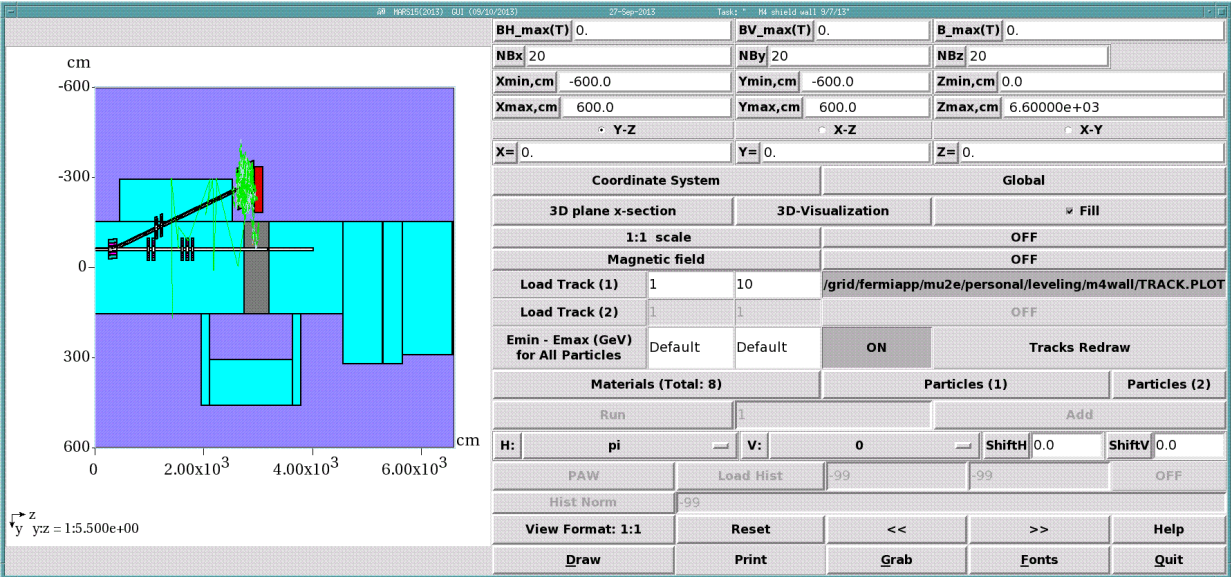
Moving on to Problem #9.

Added a labyrinth around the shield wall. Also added a 4' thick, 5' wide steel block, 5 feet long at the back side of the dump. Also increased the size of the dump core to 2'x2'x4' long. Something reasonable should happen as a result of all of this. M1512.f has been run to check volumes for these new feature.

After talking over result of problem #8 with muon department, decided to shorten leg 2 to 30 to 50 feet.

Need to revert to stage 1. I will save 1512.f with a different name so I can start to keep versions of various geometries.

Here is the model with NEVT at 10:



which looks pretty good. Tracks at the surfaces may be very difficult to produce. I'll launch 10000 ip which should be safe and produce an output in less than 1 hour. Also, Andrei has made a more permanent change to the submittal process, so the command is truncated to mu2emars -executable . .

There is some trouble with the new command, so I launched by the old method a test run with 10000 IP. Talked some more with Andrei. I edited .profile by his instructions and now I can launch with mu2emars and without the extra trail of path.

Launched at 1000 ip job after killing the 10,000 IP one. I didn't want to wait a couple of hours to check for lines in a fort.71 file. NO lines were written in a fort.71 file with just 1000 IP; the run time was 1042 seconds. I'll go ahead and resubmit a 5k job which will probably take just shy of 90 minutes.

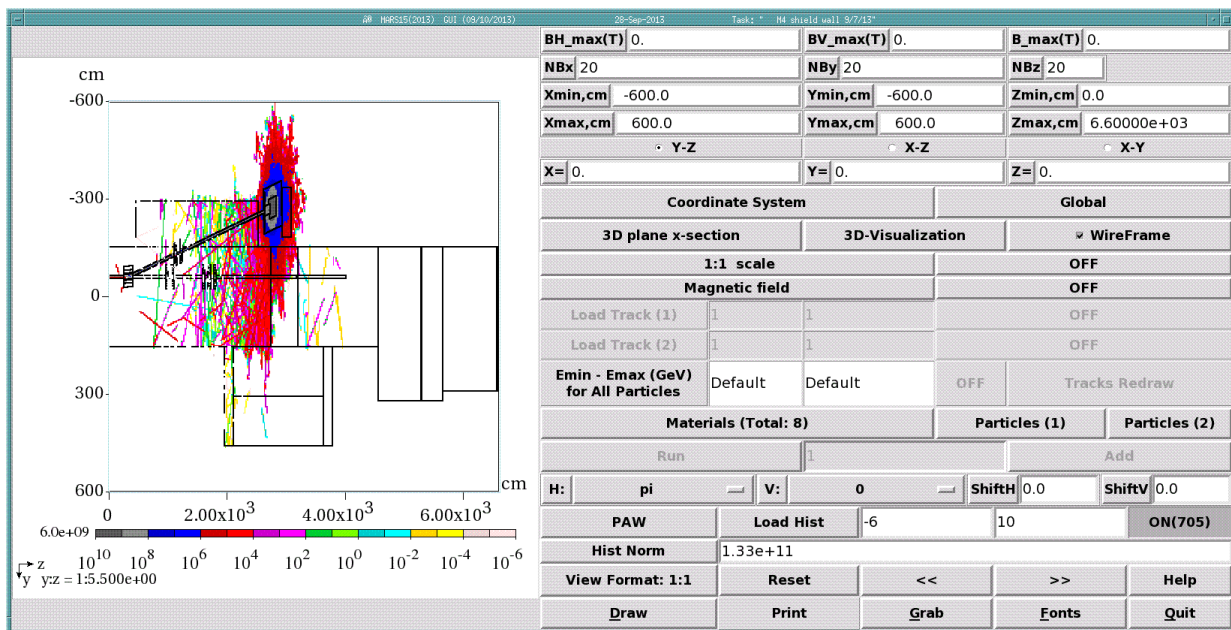
The 5k job took 6066 seconds and produced just one line. It would take 1E9 IP to get 2E5 lines in a stage 2 input file. Need to back off on the design somehow. First, just remove the steel backstop and try again. Just changed the material back to GTIL and resubmitted the job. Launched 11424715 at 2146.

9/28/13

The 5 k job finished at 2328 with 9 lines. Here is the calculated run time, njobs, and IP:

desired # of lines (STACK)	desired run time (seconds)	Trial IP	trial run time (seconds)	achieved # of lines	required IP (PRIME)	required njobs	IP per job
2.00E+05	36000	5.00E+03	6024	9	111111111	3719	29880
				actuals		4000	27778

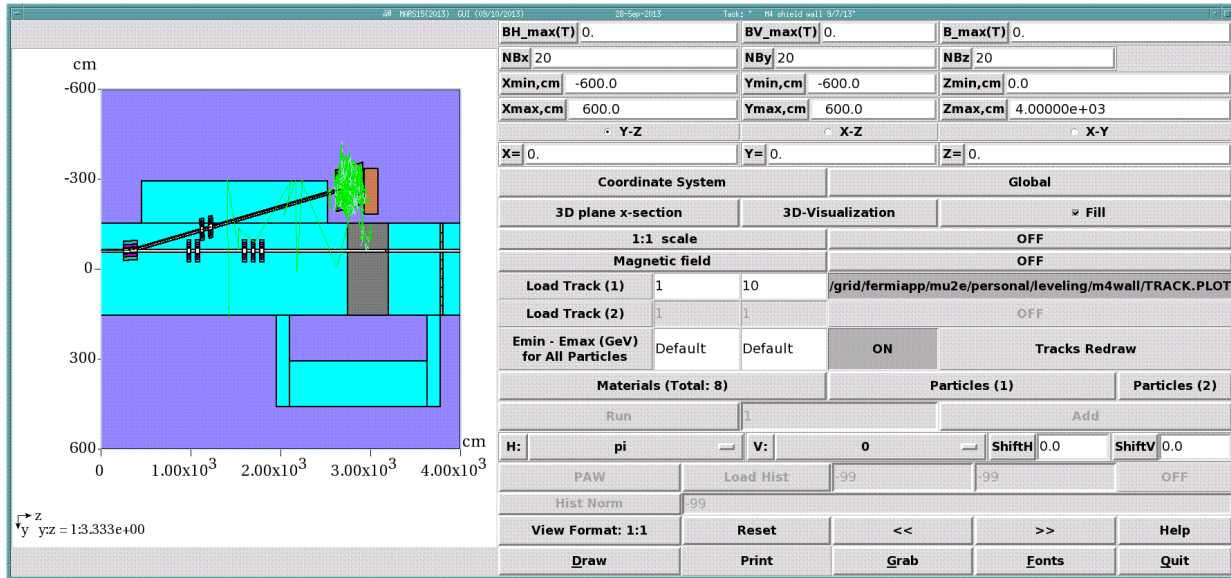
Here is the flux picture:



This does not look promising. There is a lot of computing time and, scaling by the number of lines produced, this is not likely to be a sufficient solution to problem #9.

So the problem is we need a least a factor of 50 reduction in the peak rate from results in problem 8 (2.62/0.05). Scaling by lines, we go 30 lines from 10,000 ip in problem 8. For stage 1 with problem 9, I got one line. It seems the increased core and DS steel are doing the job, but statistics will be hard to achieve. I'm going to move the wall detector to begin at the DS end of leg 3 of the labyrinth across the m4 tunnel and see what kind of prompt rates we get. I'll move the particle surface to the US side of the m4 detector wall just in case it is needed and cut the model length back to the original 40 meter to reduce run time.

OK, modeled is shortened to 40 m, particle surface and detector wall are moved, volumes are recalculated, and job has been recompiled. I'm still concerned about getting a good statistics answer, but maybe we just blast away with a lot of jobs. Here is the new model with 10 particle tracks.



So launching 1000 ip to check run time, etc. Run time is 826 seconds. Of course there is no fort.71 file. A four hour run would result from about 18000 ip. I'll launch 4000 jobs and then check statistics. This is done at 0728.

Created /grid/fermiapp/mu2e/users/leveling/m4wall/output/ds_dump_extra_steel/run_00* for the 8 jobs resulting from the extra steel run.

Here is the completed file listing:

```
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 28 19:58 11424800
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 28 19:34 11424799
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 28 19:04 11424798
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 28 18:14 11424797
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 28 15:14 11424796
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 28 14:31 11424795
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 28 13:58 11424794
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 28 13:50 11424793
```

9 jobs out of 4000 did not finish (yet). Ignoring these for now. Processed 8 sets of files and then formed up single files from those 8. Conclusions are included in the PPT. Essentially, I've been working with the wrong size dump for the application – one that requires personnel access downstream of it.

In problem #10, a dump core 6' x 6' x 5' long is used. No particle file will be produced so no mfill in this problem. Leave the detector wall in place at the DS edge of labyrinth leg 3. Need to recalculate volumes and fix the detector histogram. Did all of that and launched a trial run at 1056 with 1000 IP. Put model images and tracks images in PPT. No tracks appear DS of the shield wall. This might be the one. It took 1618 seconds for 1000 ip. Cut out the shield wall histograms to save CPU time and have launched another 1000 ip test queue job at 1158. No time savings with the histograms removed. I

suspect not much was happening there anyway. 11000 ip takes about 5 hours. Launched 5000 jobs of 11000 ip at 1235.

9/30/13

Here are the completed files from the big_dump run:

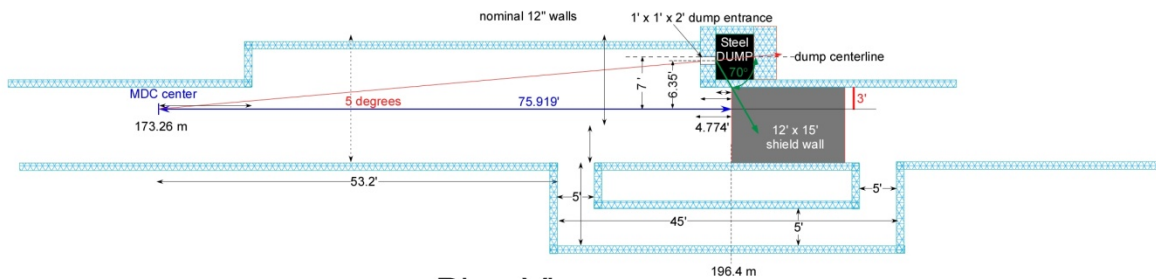
```
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 30 03:46 11458557
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 30 03:08 11458556
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 30 02:25 11458555
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 30 00:23 11458554
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 29 23:53 11458553
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 29 23:29 11458552
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 29 22:54 11458551
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 29 22:26 11458550
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 29 20:33 11458549
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Sep 29 18:53 11458548
```

Processed output files are stored at m4wall/output/big_dump. It took a little over half an hour to process the files using two windows, one with odd directories and one with evens.

10/1/13

Reviewed the output for problems 8, 9, and 10 in a mini-meeting with Jerry, Dean, Jim, and Steve. We came to a consensus on problem #11 which springs from the following drawing and an updated sketch by Jim:

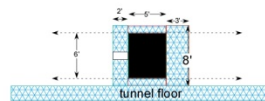
M4 line diagnostic beam dump location plan



Plan View

NOTES:

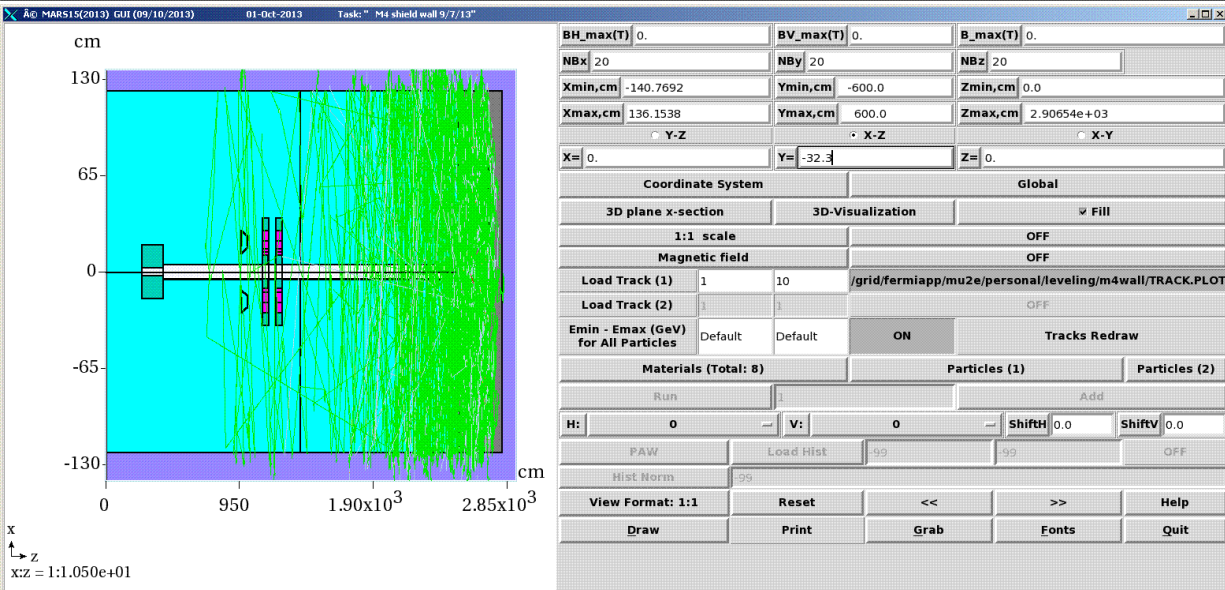
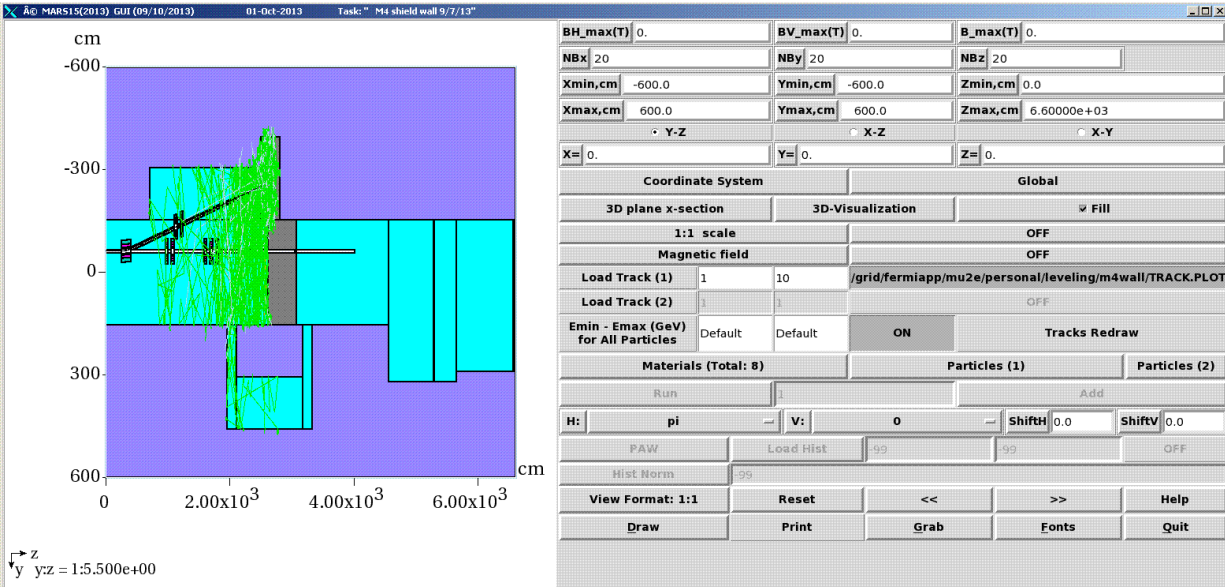
1. dump core steel is 6' x 6' x 5' long
2. dump core position is defined by triangle
 - a. base is MDC to shield beam line 75.919' (blue)
 - b. beam trajectory forms second side (red)
 - c. a ray 70° from beam trajectory intersects beam left corner of shield wall (green)
3. Entrance hole to dump is 1' x 1' x 2'. Position is optimized along beam trajectory
4. Dump upstream wall is 2' concrete structural wall
5. MDC and US shield wall positions are locked as shown



Dump Elevation View

T. Leveling
October 1, 2013

Preliminary runs with tracks are shown in the following images:



The detector wall is moved DS to 6550 cm. The detector volume is now just two instead of 210 in order to get better statistics. The dump is now squared up with the m4 line enclosure. A massive dump core 6' x 6' x 5' is used instead of the 1' x 1' x 4'. The length of labyrinth leg 2 is shortened to 35 feet (full length is 45'). Launched 5000 jobs by 1347.

10/2/13

Unlike over the weekend, this set of 5000 jobs is taking a lot time to complete. Present status is:

```
drwxrwsr-x 215 marsmu2eana marsmu2e 14336 Oct  2 06:09 11483687
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct  2 06:01 11483159
drwxrwsr-x 40 marsmu2eana marsmu2e 4096 Oct  2 05:19 .
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct  2 03:28 11483147
```

Two of 10 sets are complete. Files are processed in cdpers/m4wall/output/big_sq_dump/.

By about 1550, the fourth set of jobs was completed. At this time(1950), 2340 jobs remain.

10/7/13

The last of the jobs finished on October 3 at 0642. Here is a complete listing:

```
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 3 06:42 11483725
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 3 05:01 11483720
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 3 04:06 11483715
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 3 01:06 11483710
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 2 22:20 11483704
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 2 20:05 11483699
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 2 15:50 11483694
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 2 11:49 11483687
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 2 06:01 11483159
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 2 03:28 11483147
```

All jobs are processed and histograms are posted in PPT.

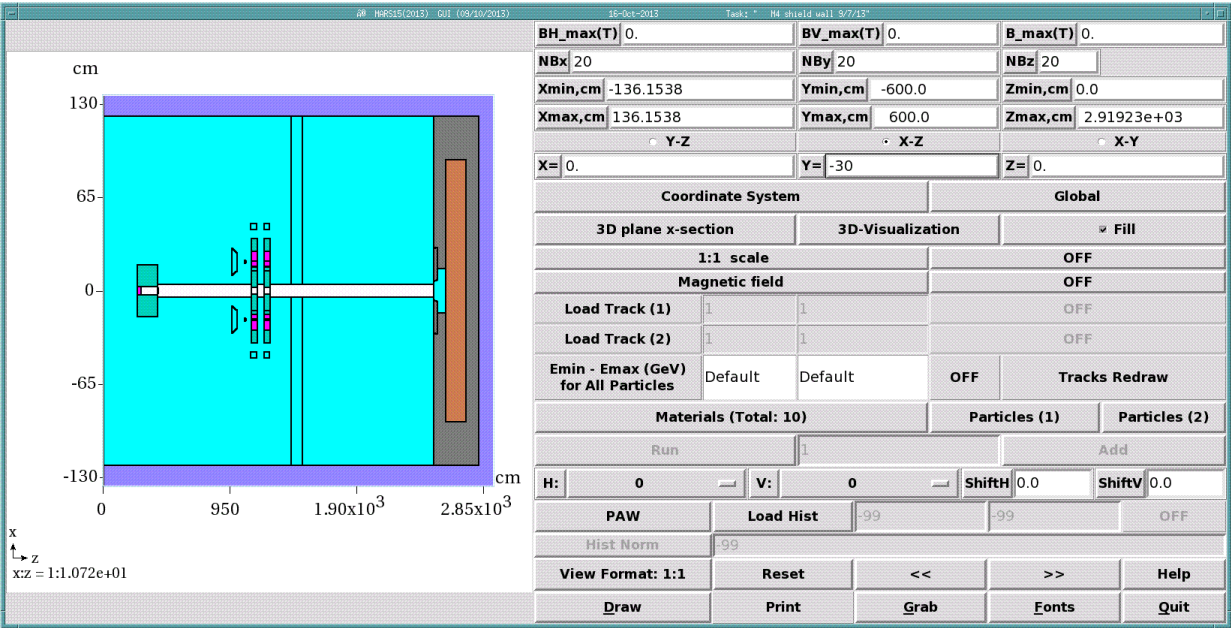
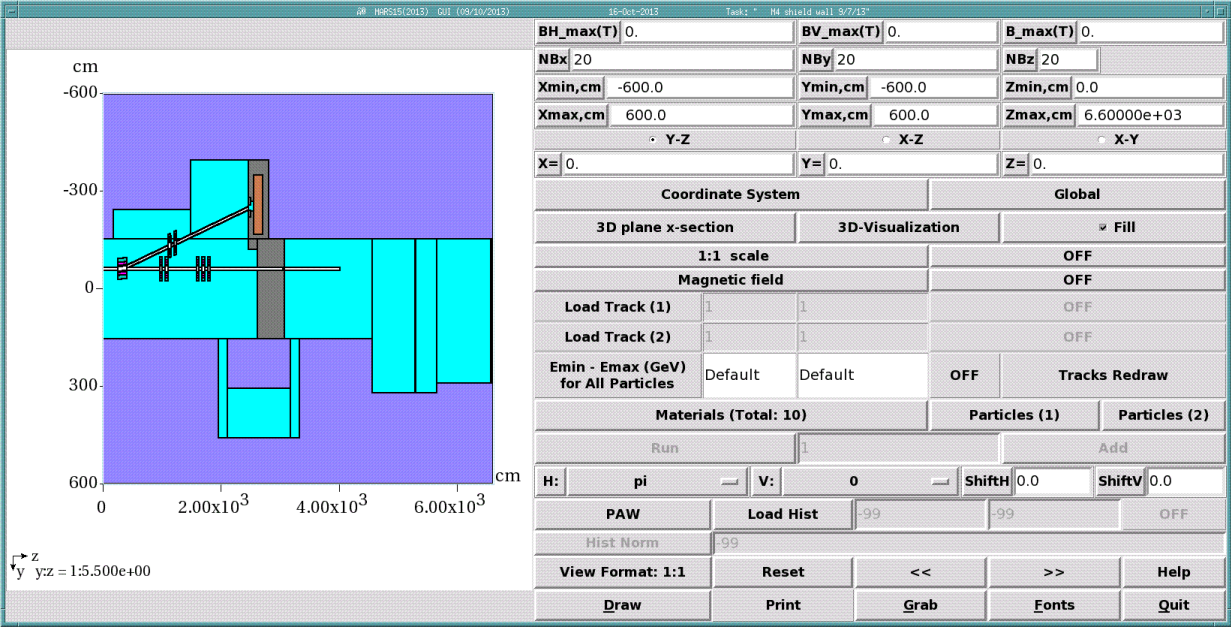
10/16/13

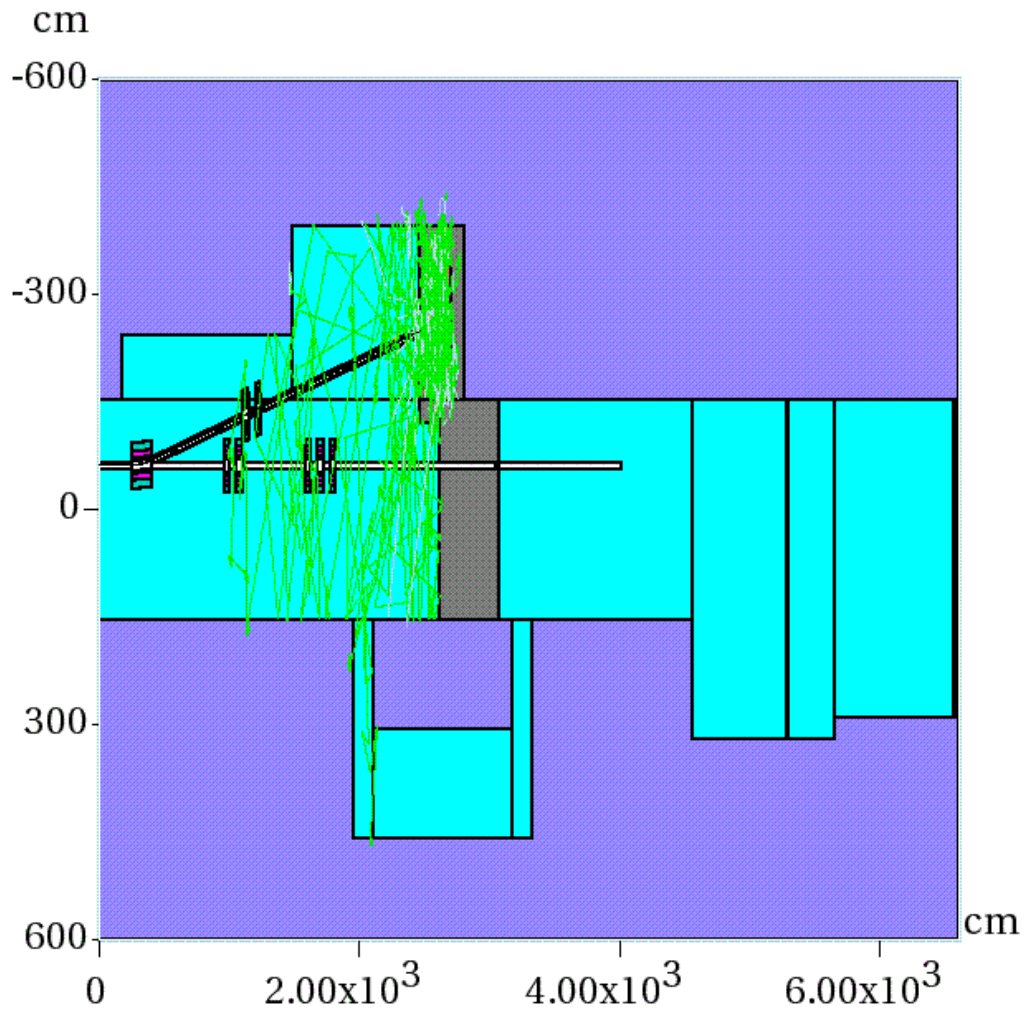
Had another meeting – this time about the results of problem #11. There is one last iteration due to adjustments made by FESS which are favorable to the latest design. Also need star density for the dump. After talking to Kamran, just need the peak star density for the GW calculation. Model adjustments are:

1. Move dump core 6" to beam right
2. Change DS air bump to put dump inside the tunnel
3. Change tunnel air volume
4. Make dump concrete unique from shield wall concrete
5. Make dump US concrete wall 3' thick for residual dose reduction
6. Make a second DA tunnel bump
7. Establish histogram volumes for dump star density (left, DS, above, below)
8. Get latest TLM response
9. Make another attempt to measure prompt rates at DS end of M4 enclosure – should get harder with the dump core move.

Keep in mind that m1512.f has been named stage1.f for the latest round of problems.

Model changes have been made and stage1.f file has been updated with corrected volumes. Here are some images of the model:



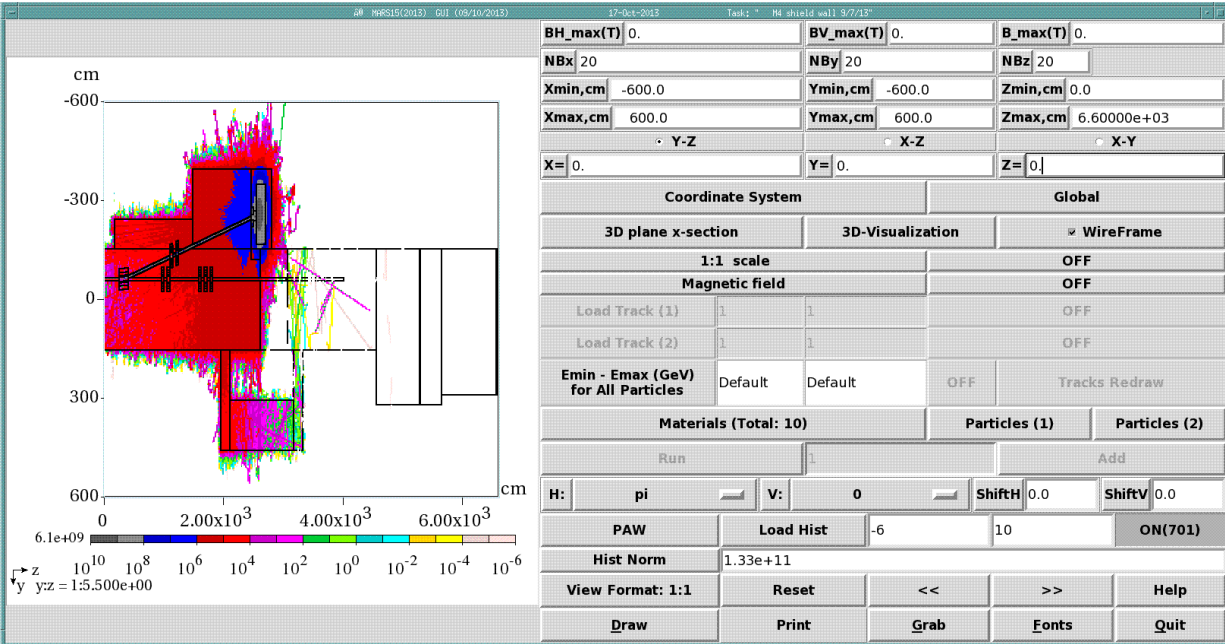


$\begin{matrix} \rightarrow z \\ \downarrow y \end{matrix}$
 $y:z = 1:5.500e+00$

Launched a test-queue job (11732387) at 1521 with 1000 ip to determine run time, etc. Job finished in 1637 seconds. 11,000 ip per job would require 5 hours per job. Launched 5000 jobs at 1706.

10/17/13

Only 4 jobs have completed overnight and only 2 jobs are running at this time. So it's going to be awhile to get the complete answer. Here is an image showing total flux. The design looks good.



Submitted a help desk ticket this morning about the jobs sitting in queue. Idle jobs were held in queue overnight in preparation for grid maintenance today – PITA! Jobs have started running once again before 1400.

10/21/13

The last of the jobs finished up at 0632 on 10/19. Moving on to post processing. Here is the list of files:

```
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 19 06:32 11736964 -9
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 19 00:13 11736961 -8
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 18 17:41 11736963 -7
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 18 13:49 11736962 -6
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 18 10:13 11736960 -5
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 18 09:12 11736959 -4
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 18 06:57 11736958 -3
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 18 05:07 11736957 -2
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 18 04:28 11736955 -1
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 18 01:52 11736956 0
```

All 10 file sets are processed and then combined in m4wall/output/last_sq_dump. Next steps are:

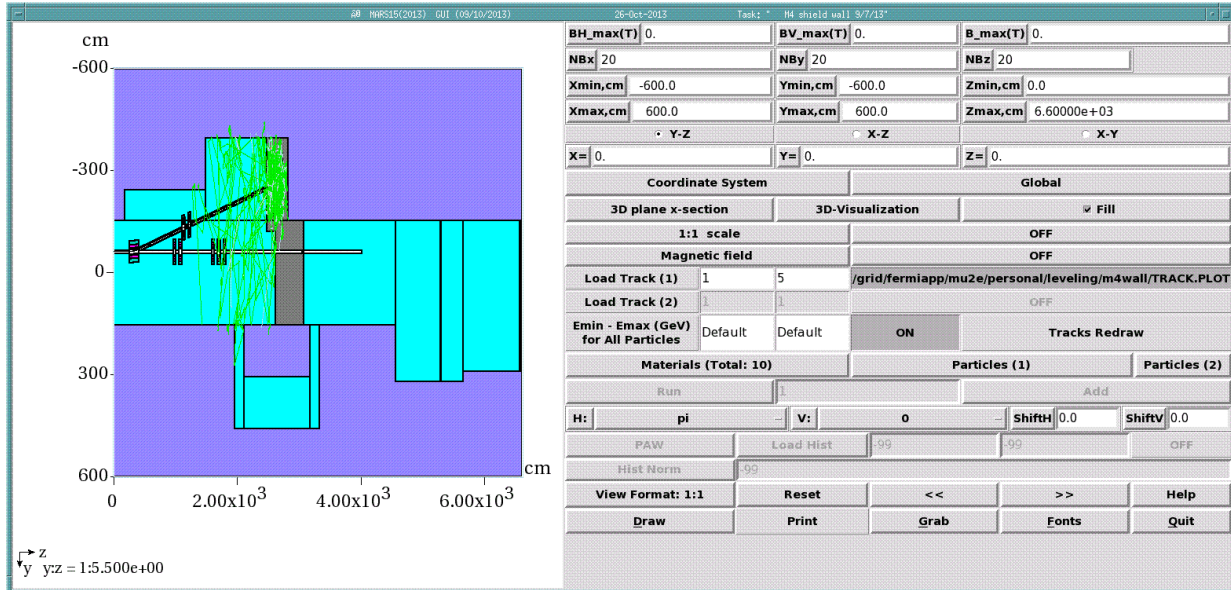
1. Create/copy GUIs into this document
2. Process the MTUPLE.EXG result both for the DS detector parts and for the TLM US of the shield wall.
3. Update the PPT with this last set of results.
4. Put the large PPT into doc.db
5. Make a version 2 of the PPT truncated to the final solution.

10/26/13

I need to make one final run. In problem 12, I got the steel starting 25" US of the shield wall. It's supposed to be 19-1/8". This new position should be superior since more steel is to the right of the

beam trajectory. Also, I did not get any stars DS of the dump core, so I want to make sure about the dimensions of the histogram regions. I will reduce these to just the foot print of the dump sides to obtain the maximum star density. I should be able to tweak GEOM.INP without affecting model volumes.

Here is the GUI following making model adjustments.



Launched a 1000 ip trial run from the command line at 0905 because the test queue job mode probably doesn't work since I have an m5 wall job running right now.

The job finished up at about 0930. The 11000 IP 4 to 5 hour run time should work out about right for this final run. Histograms outside the dump and for the job looked good (including the one DS of the dump). Launched 5000 jobs at 0953 for this problem.

10/28/13

The jobs finished up yesterday at 1255:

```
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 27 12:55 11914142 - 9
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 27 10:33 11914146 - 8
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 27 09:01 11914145 - 7
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 27 07:29 11914144 - 6
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 27 07:06 11914143 - 5
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 27 03:15 11914141 - 4
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 27 02:12 11914140 - 3
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 27 00:24 11914139 - 2
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 26 22:54 11914138 - 1
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Oct 26 22:00 11914137 - 0
```

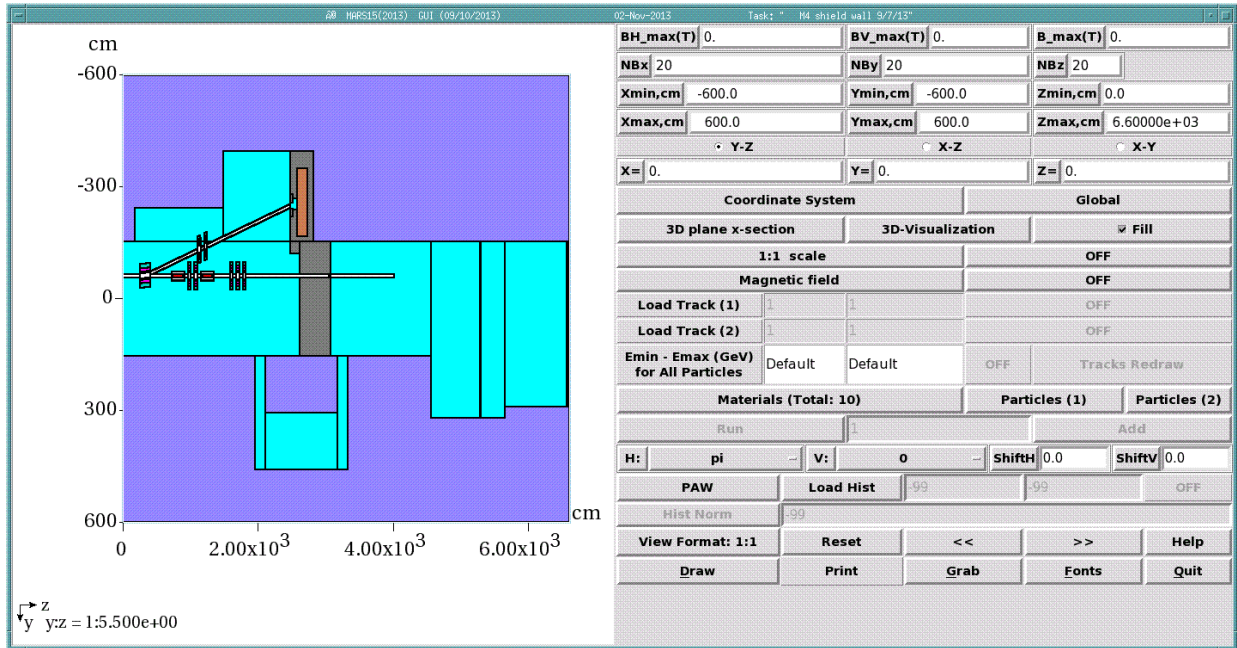
Files have been processed with `r_average` and are stored at:

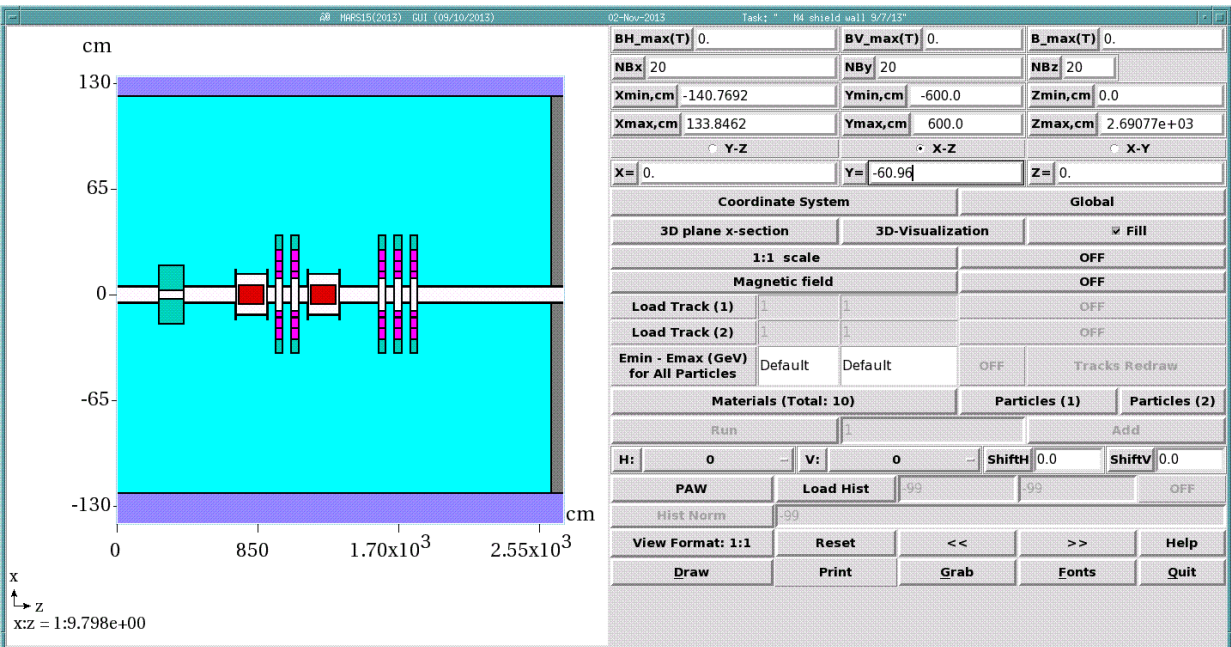
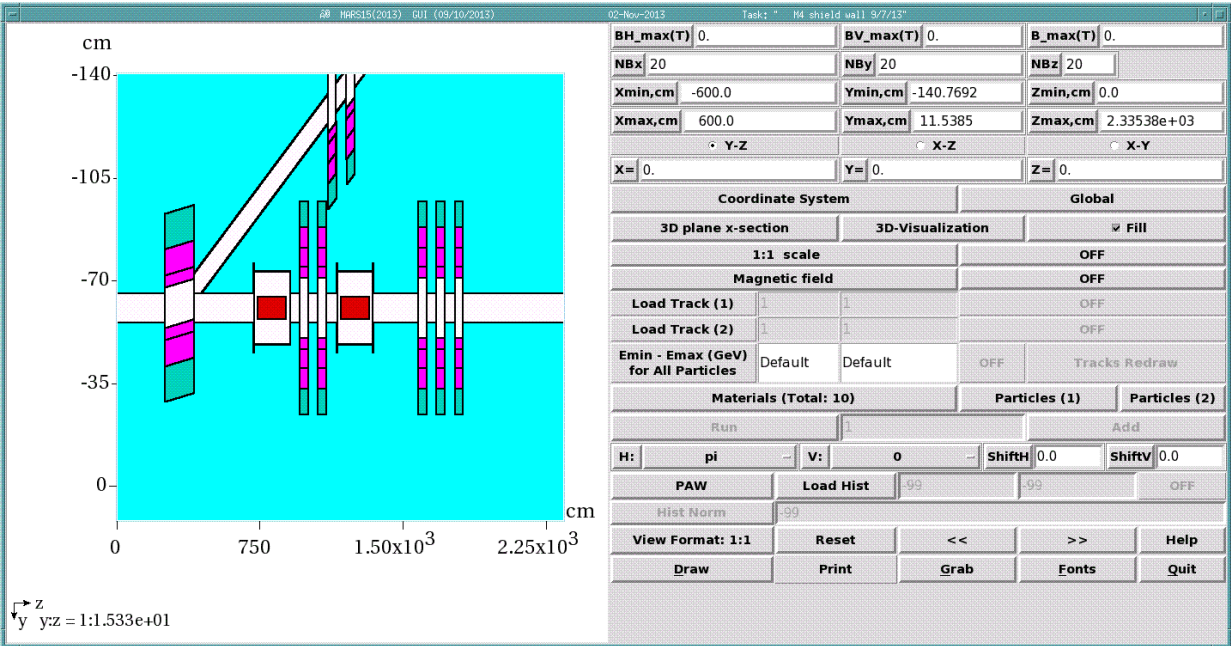
`/grid/fermiapp/mu2e/users/leveling/m4wall/output/13_final_sq_dump`

Next step is to update PPT slides. – DONE

11/2/13 – Problem #14

Jerry asked the question about the accident condition, for example, scraping on the MDC magnet and is the dose rate at the end of the M4 line tolerable for unlimited occupancy. I have a stage 1 file, but it isn't quite accurate because the dump design has changed. I believe the TLM will protect against the accident condition, but need to check. In the worst case, a chipmunk with a 0.25 mrem/hr trip level would probably provide redundant, sufficient protection. A calculation should be made though to determine what losses can be tolerated. To do this, the two critical device beam stops will be added to the M4 line to block the beam pipe through the shield wall. Consulted MSD drawings of the pbar beam stop to get dimensions. I should be able to minimize volume calculations by putting the beam stops in as late as possible in the GEOM.INP file. See model which now includes beam stops

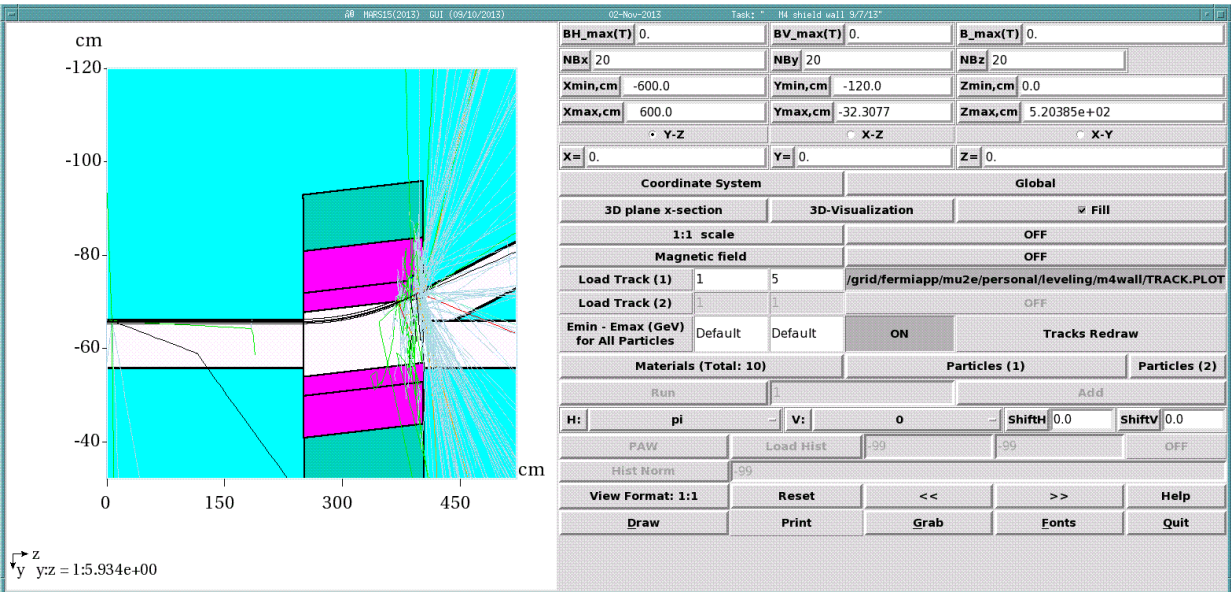
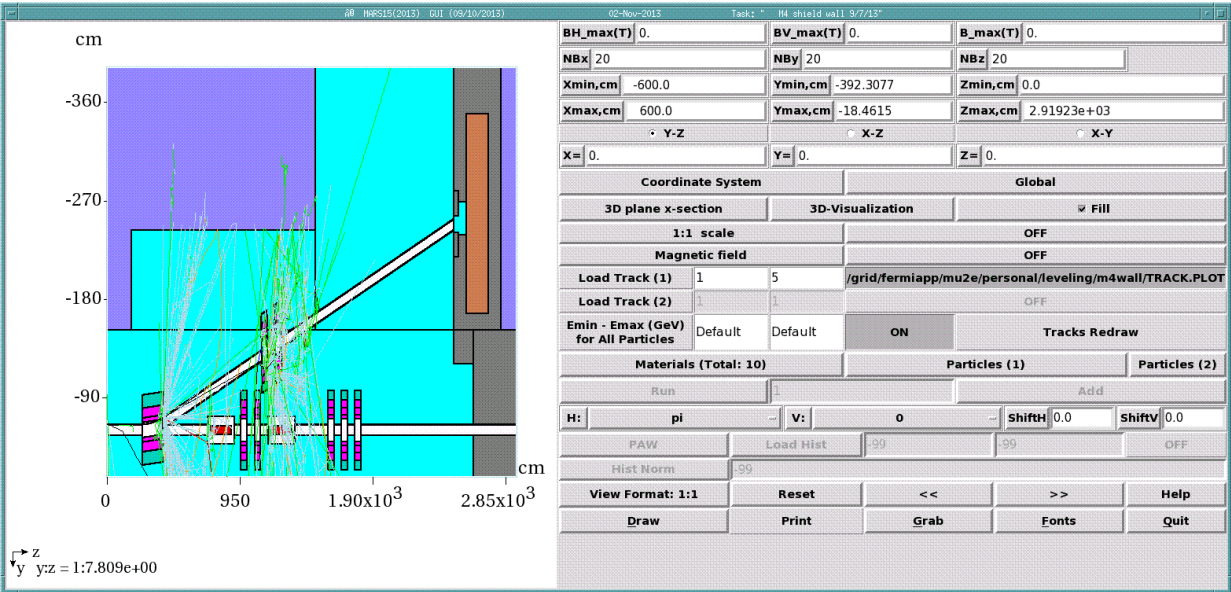




Above is an elevation view of the beam line.

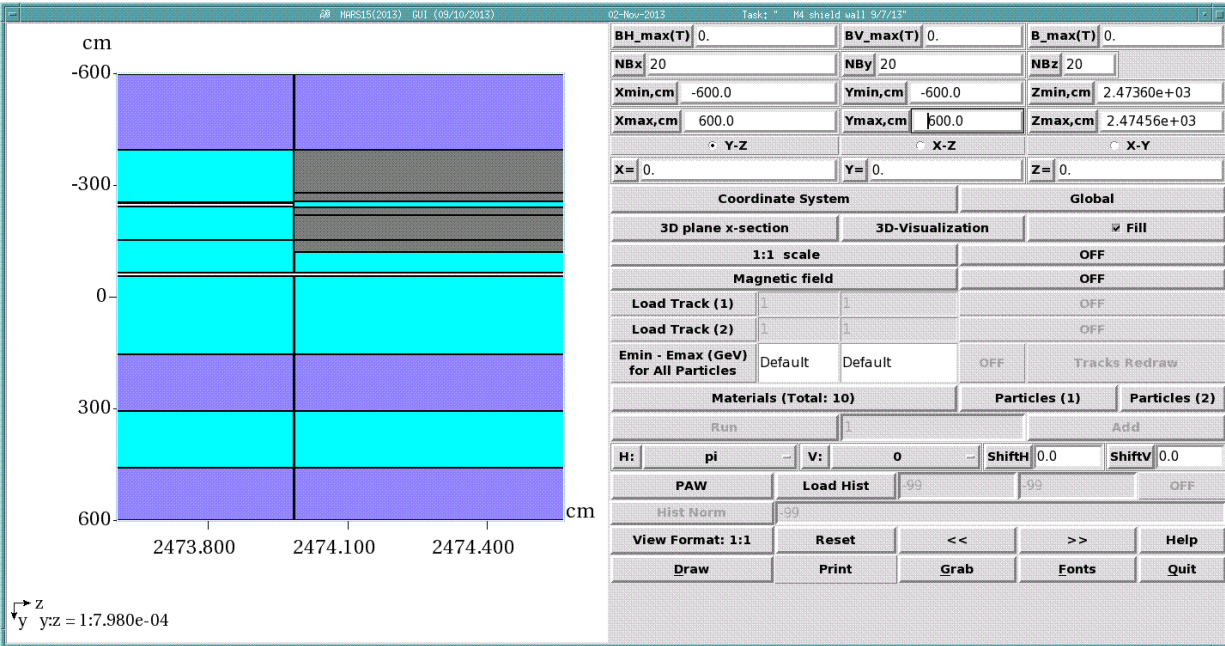
Have calculated volumes for subroutine vfan for the new devices. Recompiled stage1.f For the beam loss condition, previous moved the beam 5 cm left to clip the MDC. Using the same condition for this job. Turning off the 5=1E-12 feature for a stage 1 run. Need to create an mfill subroutine for stage 1 run; just plan to use the 2 detectors at the end of M4 line to get dose rate for the accident condition.

Here are some gui images of the beam loss tracks:



No beam will make it to the dump in this case – pretty severe.

Need to create a surface across which particles will be trapped. I'll make a 0.001 cm vacuum space and try that with radius = RSEC=600 cm. Particle surface can be seen in the following image. The location begins consistent with the US surface of the dump at 2473.983. Next, need to put this surface in subroutine fill. That's done and fort.71 collects lots of particles. Also needed to create mcnp STST which is done. Had trouble with this previously – just needed to use 25055 instead of 25000.



Launched a trial with 10,000 ip. The job ran 3443.93 seconds and produced 10,125 lines. Want at least 3E5 lines for stage 2 file. 30 jobs with 100,000 ip should produce 3E5, but maybe I should run 5E5 instead. So, launching 50 jobs with 10,000 ip each for stage 1. The job number is:

50 job(s) submitted to cluster 12100627.

11/3/13

Jobs finished yesterday at 1945:

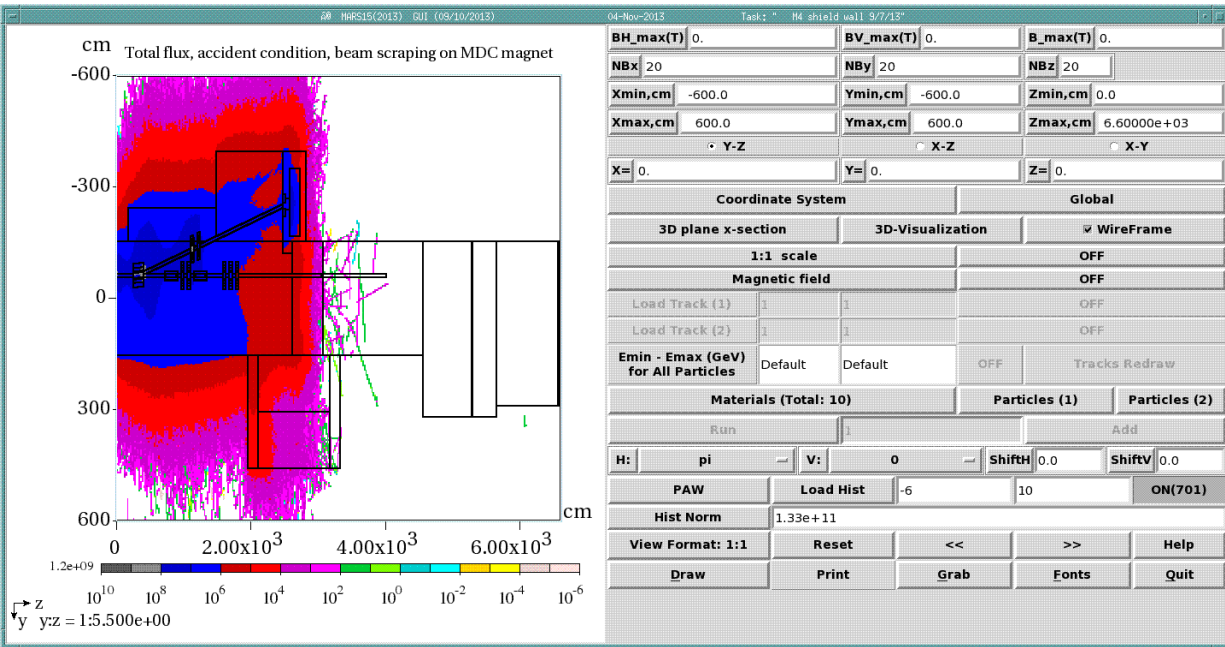
drwxrwsr-x 52 marsmu2eana marsmu2e 4096 Nov 2 19:45 12100627

Next, need to concatenate files, r_average output files, check stage 1 results at the detectors, and decide if a bigger stage 1 is required (no stage 2) or to run stage 2.

More mistakes – beam ran cleanly to the dump; forgot to change the beam position for the grid run. Resubmitting the job at 0539. New files done at 0648.

drwxrwsr-x 52 marsmu2eana marsmu2e 4096 Nov 3 06:48 12108389

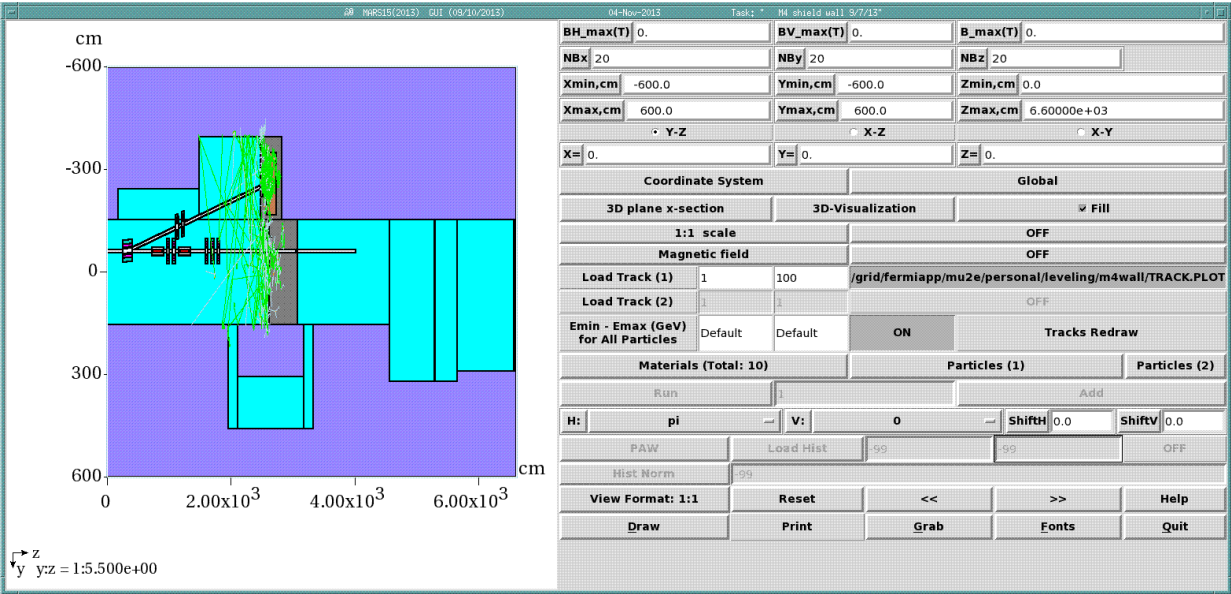
Here is total flux picture from the stage 1 run:



Things to do:

1. Comment out mfill - done
2. Add open statement – fix path - done
3. Add beg1 - done
4. Comment out beam parameters - done
5. Set enrg 5=1e12 - done
6. Rm *.o - done
7. Recompile - done
8. Set stack (808,010) and prime (500,000) – done
9. Edit stagefile for correct particle file - done
10. Test run from command line – done, OK
11. Test run on grid – done at 0728 job number [12108527](#)
12. Run on grid

Here are tracks from a trial run with the stage 2 input file:



The test run completed in 1240 seconds with good looking statistics. Launched 1000 jobs each with 1E6 ip which should finish up in under 4 hours. Accident condition dose rate looks like about 10(s) mrem/hr. Job was launched at 0925.

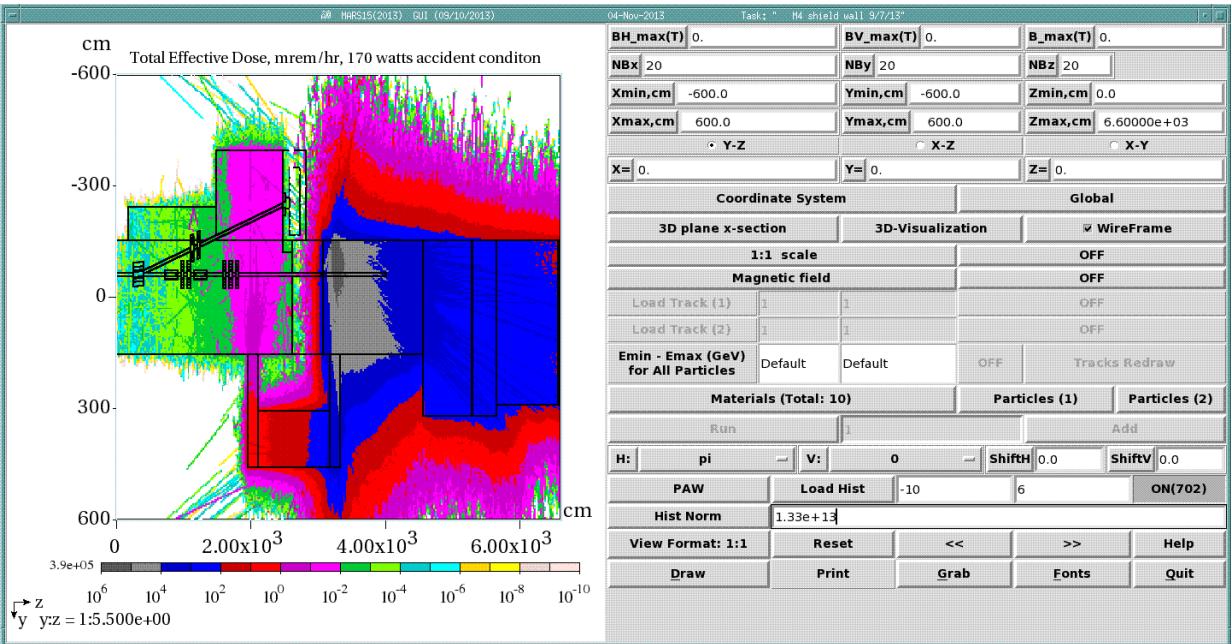
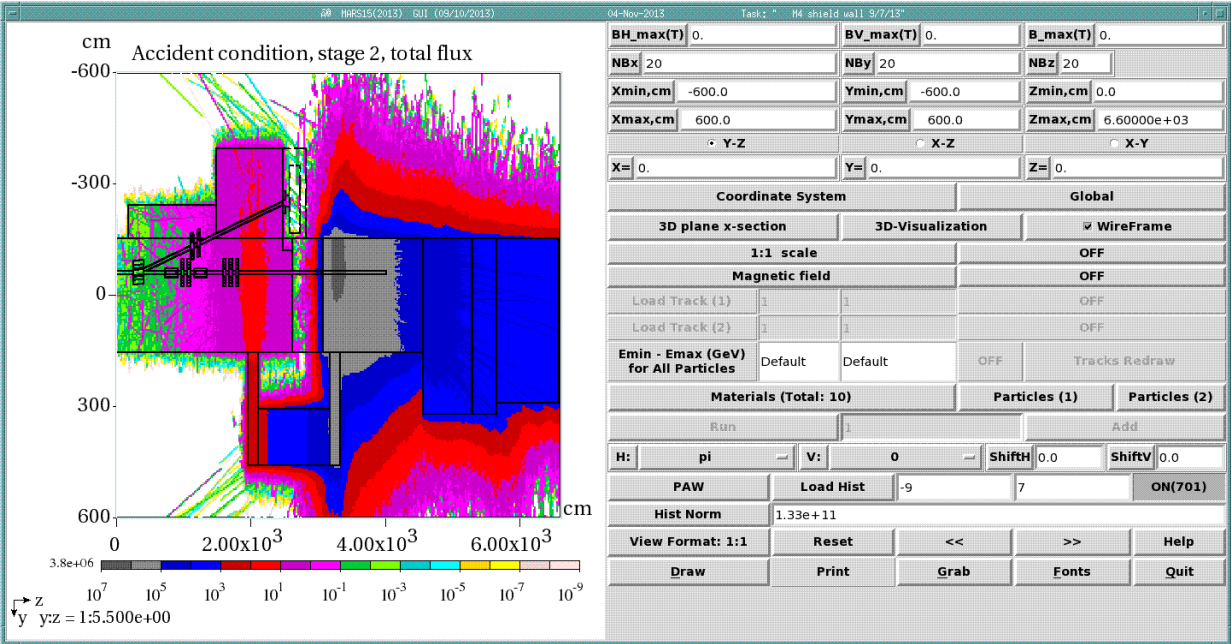
11/4/13

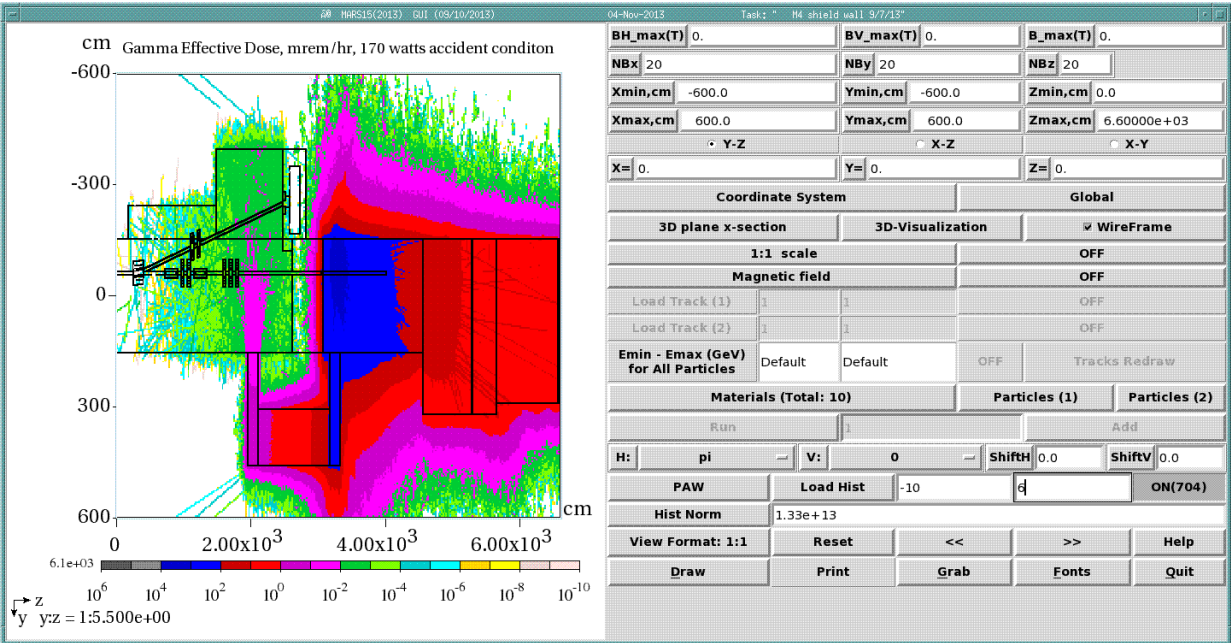
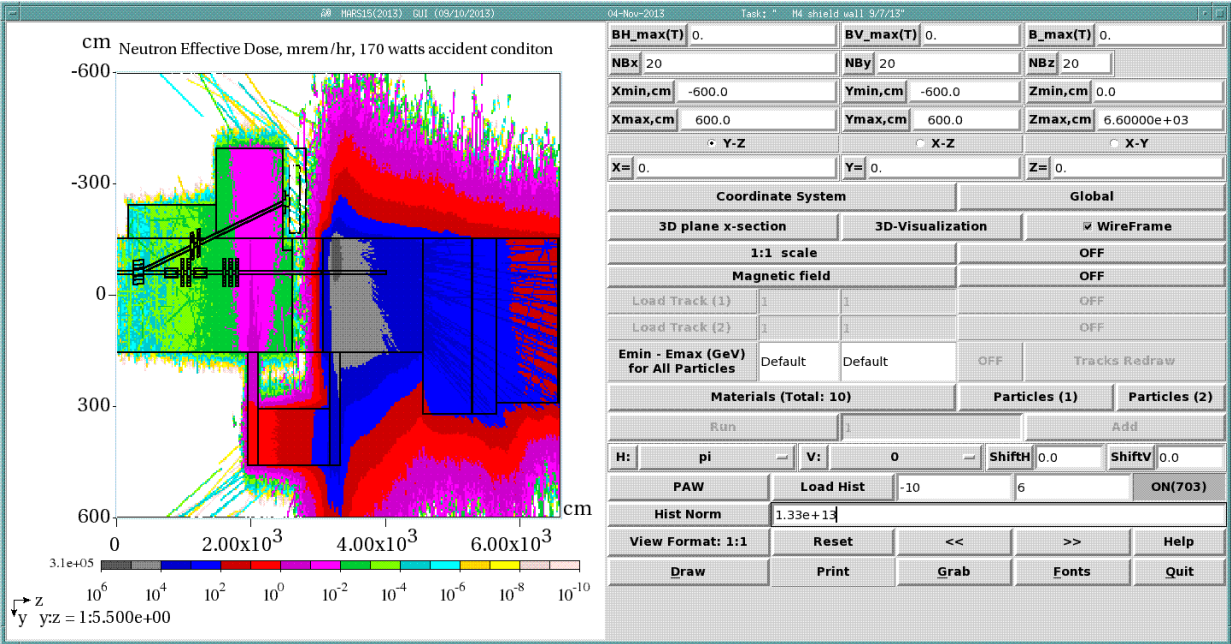
Jobs finished up at 1353:

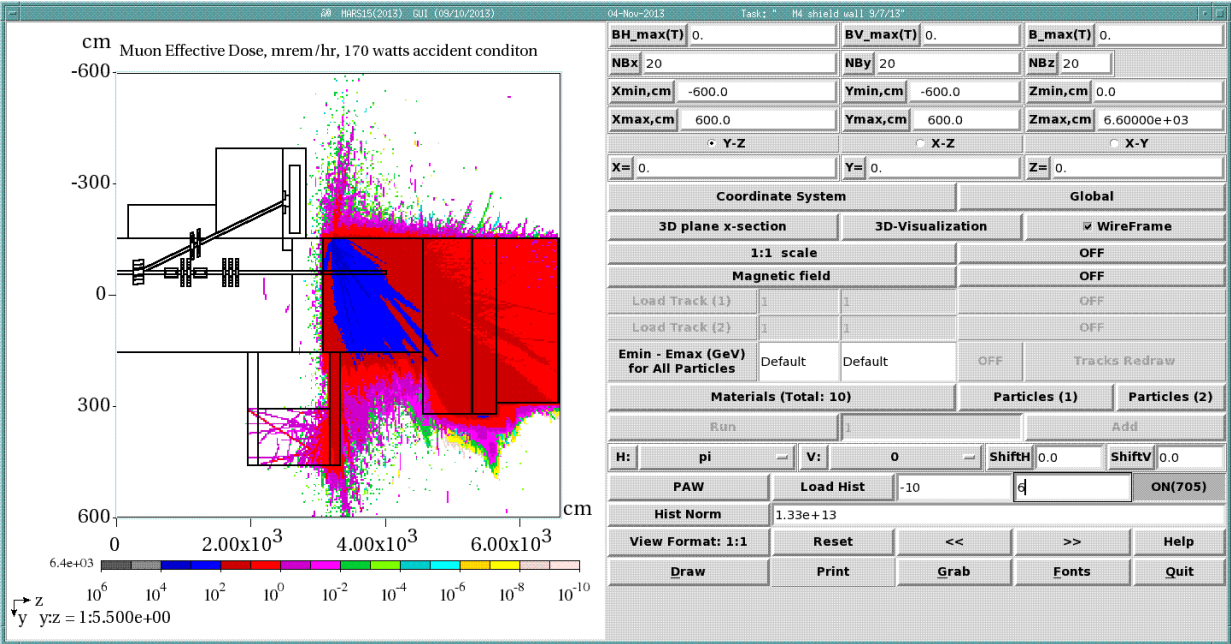
```
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Nov 3 13:53 12109177
drwxrwsr-x 502 marsmu2eana marsmu2e 32768 Nov 3 13:32 12109181
```

I don't need the star density plots with this run, but they are included. Need to process MTUPLE.EXG for detector results and TLM response, and prompt rates from mars.hbook.

Here is total flux from the stage 2 run.

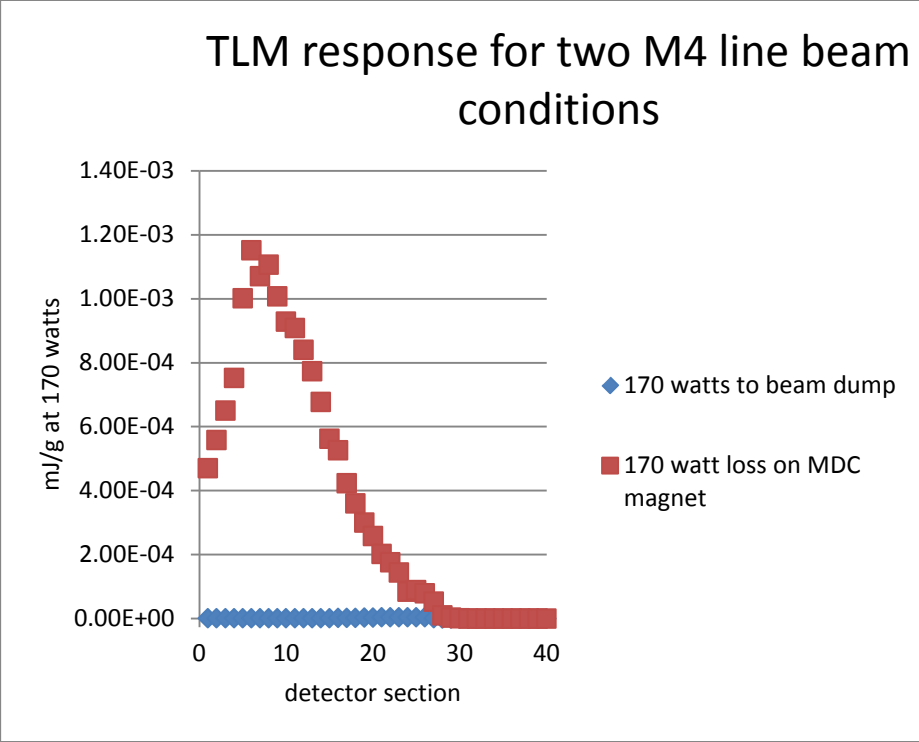






Here are the results from detector 1 and 2 at the end of the M4 line for 170 watt accident on the MDC magnet:

Detector	mSv/p	Error	
1	2.32E-15	1.17E-17	0.5%
2	5.26E-15	1.71E-17	0.3%
mrem/hr per 170 watt accident loss			
1	1.11E+02		
2	2.52E+02		



Input files for the latest version of the model are included below. All files will be available on the grid for a time at:

`/grid/fermiapp/mu2e/users/leveling/m4wall`

GEOM.INP

M4 diagnostic beam absorber and shield wall 9-5-13
! OPT - not optimized need volmc to include in m1510.f

```
!Q942*****
!Construct coil volume from 12 shapes
12coil1 1 0 4 24.13 -60.96 954.3 3.493 8.89 43. 1 1 ! 12coil1
3coil1 1 0 4 0. -36.83 954.3 8.89 3.493 43. 1 1 ! 12coil1
6coil1 1 0 4 -24.13 -60.96 954.3 3.493 8.89 43. 1 1 ! 12coil1
9coil1 1 0 4 0. -85.09 954.3 8.89 3.493 43. 1 1 ! 12coil1
12coil2 1 2 4 19.55 -59.34 954.3 6.35 3.429 43. 1 1 ! 12coil2
3coil2 1 2 4 -1.62 -41.41 954.3 3.429 6.35 43. 1 1 ! 12coil2
6coil2 1 2 4 -19.55 -62.58 954.3 6.35 3.429 43. 1 1 ! 12coil2
9coil2 1 2 4 1.62 -80.51 954.3 3.429 6.35 43. 1 1 ! 12coil2
12coil3 1 3 4 19.55 -62.58 954.3 6.35 3.429 43. 1 1 ! 12coil3
3coil3 1 3 4 1.62 -41.41 954.3 3.429 6.35 43. 1 1 ! 12coil3
6coil3 1 3 4 -19.55 -59.34 954.3 6.35 3.429 43. 1 1 ! 12coil3
9coil3 1 3 4 -1.62 -80.51 954.3 3.429 6.35 43. 1 1 ! 12coil3
!End of coil shapes
!begin iron shapes
!pole faces
230pole 2 0 2 8.023 -52.937 954.3 0.0 6.985 43. 1 1 !
430pole 2 0 2 -8.023 -52.937 954.3 0.0 6.985 43. 1 1 !
730pole 2 0 2 -8.023 -68.983 954.3 0.0 6.985 43. 1 1 !
103pole 2 0 2 8.023 -68.983 954.3 0.0 6.985 43. 1 1 !
!make beam vacuum space
sqavac 2 0 0 0. -60.96 954.3 0.0 10.16 43. 1 1 !
!block out iron corners
air1 1 4 3 32.32 -28.64 954.3 12.7 30. 43. 1 1 ! air1
air2 1 5 3 -32.32 -28.64 954.3 12.7 30. 43. 1 1 ! air2
air3 1 4 3 -32.32 -93.28 954.3 12.7 30. 43. 1 1 ! air3
air4 1 5 3 32.32 -93.28 954.3 12.7 30. 43. 1 1 ! air4
!make remaining coil fill
coilfill 2 0 4 0. -60.96 954.3 0.0 14.00 43. 1 1 !

!iron laminations
felam 1 0 2 0. -60.96 954.3 36.195 36.195 43. 1 1 ! felam
!END OF Q942*****

!Q943*****
```

```

!Construct coil volume from 12 shapes
12coil1 1 0 4 24.13 -60.96 1050.4 3.493 8.89 43. 1 1 !12coil1
3coil1 1 0 4 0. -36.83 1050.4 8.89 3.493 43. 1 1 !12coil1
6coil1 1 0 4 -24.13 -60.96 1050.4 3.493 8.89 43. 1 1 !12coil1
9coil1 1 0 4 0. -85.09 1050.4 8.89 3.493 43. 1 1 !12coil1
12coil2 1 2 4 19.55 -59.34 1050.4 6.35 3.429 43. 1 1 !12coil2
3coil2 1 2 4 -1.62 -41.41 1050.4 3.429 6.35 43. 1 1 !12coil2
6coil2 1 2 4 -19.55 -62.58 1050.4 6.35 3.429 43. 1 1 !12coil2
9coil2 1 2 4 1.62 -80.51 1050.4 3.429 6.35 43. 1 1 !12coil2
12coil3 1 3 4 19.55 -62.58 1050.4 6.35 3.429 43. 1 1 !12coil3
3coil3 1 3 4 1.62 -41.41 1050.4 3.429 6.35 43. 1 1 !12coil3
6coil3 1 3 4 -19.55 -59.34 1050.4 6.35 3.429 43. 1 1 !12coil3
9coil3 1 3 4 -1.62 -80.51 1050.4 3.429 6.35 43. 1 1 !12coil3
!End of coil shapes
!begin iron shapes
!pole faces
230pole 2 0 2 8.023 -52.937 1050.4 0.0 6.985 43. 1 1 !
430pole 2 0 2 -8.023 -52.937 1050.4 0.0 6.985 43. 1 1 !
730pole 2 0 2 -8.023 -68.983 1050.4 0.0 6.985 43. 1 1 !
103pole 2 0 2 8.023 -68.983 1050.4 0.0 6.985 43. 1 1 !
!make beam vacuum space
sqavac 2 0 0 0. -60.96 1050.4 0.0 10.16 43. 1 1 !
!block out iron corners
air1 1 4 3 32.32 -28.64 1050.4 12.7 30. 43. 1 1 !air1
air2 1 5 3 -32.32 -28.64 1050.4 12.7 30. 43. 1 1 !air2
air3 1 4 3 -32.32 -93.28 1050.4 12.7 30. 43. 1 1 !air3
air4 1 5 3 32.32 -93.28 1050.4 12.7 30. 43. 1 1 !air4
!make remaining coil fill
coilfill 2 0 4 0. -60.96 1050.4 0.0 14.00 43. 1 1 !

!iron laminations
felam 1 0 2 0. -60.96 1050.4 36.195 36.195 43. 1 1 !felam
!END OF Q943*****

```

```

!Q944*****

```

```

!Construct coil volume from 12 shapes
12coil1 1 0 4 24.13 -60.96 1574.3 3.493 8.89 43. 1 1 !12coil1
3coil1 1 0 4 0. -36.83 1574.3 8.89 3.493 43. 1 1 !12coil1
6coil1 1 0 4 -24.13 -60.96 1574.3 3.493 8.89 43. 1 1 !12coil1
9coil1 1 0 4 0. -85.09 1574.3 8.89 3.493 43. 1 1 !12coil1
12coil2 1 2 4 19.55 -59.34 1574.3 6.35 3.429 43. 1 1 !12coil2
3coil2 1 2 4 -1.62 -41.41 1574.3 3.429 6.35 43. 1 1 !12coil2

```



```

6coil2 1 2 4 -19.55 -62.58 1574.3 6.35 3.429 43. 1 1 ! 12coil2
9coil2 1 2 4 1.62 -80.51 1574.3 3.429 6.35 43. 1 1 ! 12coil2
12coil3 1 3 4 19.55 -62.58 1574.3 6.35 3.429 43. 1 1 ! 12coil3
3coil3 1 3 4 1.62 -41.41 1574.3 3.429 6.35 43. 1 1 ! 12coil3
6coil3 1 3 4 -19.55 -59.34 1574.3 6.35 3.429 43. 1 1 ! 12coil3
9coil3 1 3 4 -1.62 -80.51 1574.3 3.429 6.35 43. 1 1 ! 12coil3
!End of coil shapes
!begin iron shapes
!pole faces
230pole 2 0 2 8.023 -52.937 1574.3 0.0 6.985 43. 1 1 !
430pole 2 0 2 -8.023 -52.937 1574.3 0.0 6.985 43. 1 1 !
730pole 2 0 2 -8.023 -68.983 1574.3 0.0 6.985 43. 1 1 !
103pole 2 0 2 8.023 -68.983 1574.3 0.0 6.985 43. 1 1 !
!make beam vacuum space
sqavac 2 0 0 0. -60.96 1574.3 0.0 10.16 43. 1 1 !
!block out iron corners
air1 1 4 3 32.32 -28.64 1574.3 12.7 30. 43. 1 1 ! air1
air2 1 5 3 -32.32 -28.64 1574.3 12.7 30. 43. 1 1 ! air2
air3 1 4 3 -32.32 -93.28 1574.3 12.7 30. 43. 1 1 ! air3
air4 1 5 3 32.32 -93.28 1574.3 12.7 30. 43. 1 1 ! air4
!make remaining coil fill
coilfill 2 0 4 0. -60.96 1574.3 0.0 14.00 43. 1 1 !

!iron laminations
felam 1 0 2 0. -60.96 1574.3 36.195 36.195 43. 1 1 ! felam
!END OF Q944*****

```

!Q945*****

```

!Construct coil volume from 12 shapes
12coil1 1 0 4 24.13 -60.96 1670.5 3.493 8.89 43. 1 1 ! 12coil1
3coil1 1 0 4 0. -36.83 1670.5 8.89 3.493 43. 1 1 ! 12coil1
6coil1 1 0 4 -24.13 -60.96 1670.5 3.493 8.89 43. 1 1 ! 12coil1
9coil1 1 0 4 0. -85.09 1670.5 8.89 3.493 43. 1 1 ! 12coil1
12coil2 1 2 4 19.55 -59.34 1670.5 6.35 3.429 43. 1 1 ! 12coil2
3coil2 1 2 4 -1.62 -41.41 1670.5 3.429 6.35 43. 1 1 ! 12coil2
6coil2 1 2 4 -19.55 -62.58 1670.5 6.35 3.429 43. 1 1 ! 12coil2
9coil2 1 2 4 1.62 -80.51 1670.5 3.429 6.35 43. 1 1 ! 12coil2
12coil3 1 3 4 19.55 -62.58 1670.5 6.35 3.429 43. 1 1 ! 12coil3
3coil3 1 3 4 1.62 -41.41 1670.5 3.429 6.35 43. 1 1 ! 12coil3
6coil3 1 3 4 -19.55 -59.34 1670.5 6.35 3.429 43. 1 1 ! 12coil3
9coil3 1 3 4 -1.62 -80.51 1670.5 3.429 6.35 43. 1 1 ! 12coil3
!End of coil shapes

```



```

!begin iron shapes
!pole faces
230pole 2 0 2 8.023 -52.937 1670.5 0.0 6.985 43. 1 1 !
430pole 2 0 2 -8.023 -52.937 1670.5 0.0 6.985 43. 1 1 !
730pole 2 0 2 -8.023 -68.983 1670.5 0.0 6.985 43. 1 1 !
103pole 2 0 2 8.023 -68.983 1670.5 0.0 6.985 43. 1 1 !
!make beam vacuum space
sqavac 2 0 0 0. -60.96 1670.5 0.0 10.16 43. 1 1 !
!block out iron corners
air1 1 4 3 32.32 -28.64 1670.5 12.7 30. 43. 1 1 ! air1
air2 1 5 3 -32.32 -28.64 1670.5 12.7 30. 43. 1 1 ! air2
air3 1 4 3 -32.32 -93.28 1670.5 12.7 30. 43. 1 1 ! air3
air4 1 5 3 32.32 -93.28 1670.5 12.7 30. 43. 1 1 ! air4
!make remaining coil fill
coilfill 2 0 4 0. -60.96 1670.5 0.0 14.00 43. 1 1 !

!iron laminations
felam 1 0 2 0. -60.96 1670.5 36.195 36.195 43. 1 1 ! felam
!END OF Q945*****

```

!Q946*****

```

!Construct coil volume from 12 shapes
12coil1 1 0 4 24.13 -60.96 1766.6 3.493 8.89 43. 1 1 ! 12coil1
3coil1 1 0 4 0. -36.83 1766.6 8.89 3.493 43. 1 1 ! 12coil1
6coil1 1 0 4 -24.13 -60.96 1766.6 3.493 8.89 43. 1 1 ! 12coil1
9coil1 1 0 4 0. -85.09 1766.6 8.89 3.493 43. 1 1 ! 12coil1
12coil2 1 2 4 19.55 -59.34 1766.6 6.35 3.429 43. 1 1 ! 12coil2
3coil2 1 2 4 -1.62 -41.41 1766.6 3.429 6.35 43. 1 1 ! 12coil2
6coil2 1 2 4 -19.55 -62.58 1766.6 6.35 3.429 43. 1 1 ! 12coil2
9coil2 1 2 4 1.62 -80.51 1766.6 3.429 6.35 43. 1 1 ! 12coil2
12coil3 1 3 4 19.55 -62.58 1766.6 6.35 3.429 43. 1 1 ! 12coil3
3coil3 1 3 4 1.62 -41.41 1766.6 3.429 6.35 43. 1 1 ! 12coil3
6coil3 1 3 4 -19.55 -59.34 1766.6 6.35 3.429 43. 1 1 ! 12coil3
9coil3 1 3 4 -1.62 -80.51 1766.6 3.429 6.35 43. 1 1 ! 12coil3
!End of coil shapes

```

```

!begin iron shapes
!pole faces
230pole 2 0 2 8.023 -52.937 1766.6 0.0 6.985 43. 1 1 !
430pole 2 0 2 -8.023 -52.937 1766.6 0.0 6.985 43. 1 1 !
730pole 2 0 2 -8.023 -68.983 1766.6 0.0 6.985 43. 1 1 !
103pole 2 0 2 8.023 -68.983 1766.6 0.0 6.985 43. 1 1 !
!make beam vacuum space

```

sqavac 2 0 0 0. -60.96 1766.6 0.0 10.16 43. 1 1 !

!block out iron corners

air1 1 4 3 32.32 -28.64 1766.6 12.7 30. 43. 1 1 ! air1

air2 1 5 3 -32.32 -28.64 1766.6 12.7 30. 43. 1 1 ! air2

air3 1 4 3 -32.32 -93.28 1766.6 12.7 30. 43. 1 1 ! air3

air4 1 5 3 32.32 -93.28 1766.6 12.7 30. 43. 1 1 ! air4

!make remaining coil fill

coilfill 2 0 4 0. -60.96 1766.6 0.0 14.00 43. 1 1 !

!iron laminations

felam 1 0 2 0. -60.96 1766.6 36.195 36.195 43. 1 1 ! felam

!END OF Q946*****

TR2 0. 0. 0. 0. 0. 53.

TR3 0. 0. 0. 0. 0. -53.

TR4 0. 0. 0. 0. 0. 45.

TR5 0. 0. 0. 0. 0. -45.

!DUMP LINE QUADS

!QDA1

!Construct coil volume from 12 shapes

12coil1 1 10 4 24.13 -60.96 0. 3.493 8.89 43. 1 1 ! 12coil1

3coil1 1 10 4 0. -36.83 0. 8.89 3.493 43. 1 1 ! 12coil1

6coil1 1 10 4 -24.13 -60.96 0. 3.493 8.89 43. 1 1 ! 12coil1

9coil1 1 10 4 0. -85.09 0. 8.89 3.493 43. 1 1 ! 12coil1

12coil2 1 6 4 19.55 -59.34 0. 6.35 3.429 43. 1 1 ! 12coil2

3coil2 1 6 4 -1.62 -41.41 0. 3.429 6.35 43. 1 1 ! 12coil2

6coil2 1 6 4 -19.55 -62.58 0. 6.35 3.429 43. 1 1 ! 12coil2

9coil2 1 6 4 1.62 -80.51 0. 3.429 6.35 43. 1 1 ! 12coil2

12coil3 1 7 4 19.55 -62.58 0. 6.35 3.429 43. 1 1 ! 12coil3

3coil3 1 7 4 1.62 -41.41 0. 3.429 6.35 43. 1 1 ! 12coil3

6coil3 1 7 4 -19.55 -59.34 0. 6.35 3.429 43. 1 1 ! 12coil3

9coil3 1 7 4 -1.62 -80.51 0. 3.429 6.35 43. 1 1 ! 12coil3

!End of coil shapes

!begin iron shapes

!pole faces

230pole 2 10 2 8.023 -52.937 0. 0.0 6.985 43. 1 1 !

430pole 2 10 2 -8.023 -52.937 0. 0.0 6.985 43. 1 1 !

730pole 2 10 2 -8.023 -68.983 0. 0.0 6.985 43. 1 1 !

103pole 2 10 2 8.023 -68.983 0. 0.0 6.985 43. 1 1 !

```

!make beam vacuum space
sqavac 2 10 0 0. -60.96 0. 0.0 10.16 43. 1 1 !
!block out iron corners
air1 1 8 3 32.32 -28.64 0. 12.7 30. 43. 1 1 ! air1
air2 1 9 3 -32.32 -28.64 0. 12.7 30. 43. 1 1 ! air2
air3 1 8 3 -32.32 -93.28 0. 12.7 30. 43. 1 1 ! air3
air4 1 9 3 32.32 -93.28 0. 12.7 30. 43. 1 1 ! air4
!make remaining coil fill
coilfill 2 10 4 0. -60.96 0. 0.0 14.00 43. 1 1 !

!iron laminations
felam 1 10 2 0. -60.96 0. 36.195 36.195 43. 1 1 ! felam
!END OF QDA1*****

TR6 0. -69.681 1101.538 5. 0. 53.

TR7 0. -69.681 1101.538 5. 0. -53.

TR8 0. -69.681 1101.538 5. 0. 45.

TR9 0. -69.681 1101.538 5. 0. -45.

TR10 0. -69.681 1101.538 5. 0. 0.

!QDA2
!Construct coil volume from 12 shapes
12coil1 1 15 4 24.13 -60.96 0. 3.493 8.89 43. 1 1 ! 12coil1
3coil1 1 15 4 0. -36.83 0. 8.89 3.493 43. 1 1 ! 12coil1
6coil1 1 15 4 -24.13 -60.96 0. 3.493 8.89 43. 1 1 ! 12coil1
9coil1 1 15 4 0. -85.09 0. 8.89 3.493 43. 1 1 ! 12coil1
12coil2 1 11 4 19.55 -59.34 0. 6.35 3.429 43. 1 1 ! 12coil2
3coil2 1 11 4 -1.62 -41.41 0. 3.429 6.35 43. 1 1 ! 12coil2
6coil2 1 11 4 -19.55 -62.58 0. 6.35 3.429 43. 1 1 ! 12coil2
9coil2 1 11 4 1.62 -80.51 0. 3.429 6.35 43. 1 1 ! 12coil2
12coil3 1 12 4 19.55 -62.58 0. 6.35 3.429 43. 1 1 ! 12coil3
3coil3 1 12 4 1.62 -41.41 0. 3.429 6.35 43. 1 1 ! 12coil3
6coil3 1 12 4 -19.55 -59.34 0. 6.35 3.429 43. 1 1 ! 12coil3
9coil3 1 12 4 -1.62 -80.51 0. 3.429 6.35 43. 1 1 ! 12coil3
!End of coil shapes
!begin iron shapes
!pole faces
230pole 2 15 2 8.023 -52.937 0. 0.0 6.985 43. 1 1 !

```

430pole 2 15 2 -8.023 -52.937 0. 0.0 6.985 43. 1 1 !
730pole 2 15 2 -8.023 -68.983 0. 0.0 6.985 43. 1 1 !
103pole 2 15 2 8.023 -68.983 0. 0.0 6.985 43. 1 1 !

!make beam vacuum space

sqavac 2 15 0 0. -60.96 0. 0.0 10.16 43. 1 1 !

!block out iron corners

air1 1 13 3 32.32 -28.64 0. 12.7 30. 43. 1 1 ! air1

air2 1 14 3 -32.32 -28.64 0. 12.7 30. 43. 1 1 ! air2

air3 1 13 3 -32.32 -93.28 0. 12.7 30. 43. 1 1 ! air3

air4 1 14 3 32.32 -93.28 0. 12.7 30. 43. 1 1 ! air4

!make remaining coil fill

coilfill 2 15 4 0. -60.96 0. 0.0 14.00 43. 1 1 !

!iron laminations

felam 1 15 2 0. -60.96 0. 36.195 36.195 43. 1 1 ! felam

!END OF QDA2*****

TR11 0. -78.0654 1197.372 5. 0. 53.

TR12 0. -78.0654 1197.372 5. 0. -53.

TR13 0. -78.0654 1197.372 5. 0. 45.

TR14 0. -78.0654 1197.372 5. 0. -45.

TR15 0. -78.0654 1197.372 5. 0. 0.

!MDC MAGNET

!vacuum

MDCmagvac 1 16 0 0. -60.96 249.8 2.8397 6.9012 152.4 1 1 1 !vacuum chamber

!end of vacuum

!inner coil

incoil 1 16 4 0. -60.96 249.8 2.8397 11.0058 152.4 1 1 1 !inner coil

!end of inner coil

!left outer coil

loutcoil 1 16 4 0. -76.4565 249.8 5.3975 4.4907 152.4 1 1 1 !left outer coil

!end of left outer coil

!right outer coil

routcoil 1 16 4 0. -45.4635 249.8 5.3975 4.4907 152.4 1 1 1 !right outer coil

!end of right outer coil

!MDC iron

MDCiron 1 16 2 0. -60.96 249.8 18.0848 32.0548 152.4 1 1 1 !MDC steel

!end of MDC iron

!dumpentrance*****

dumpentr 2 0 1 0. -249.508 2473.983 7.62 30. 30.48 1 1 ! concrete

!end of dumpentrance*****

!dumpalbedo*****

dumpalbedo 1 0 3 0. -254.508 2473.983 15.24 15.24 91.44 1 1 ! air albedo trap

!end of dumpalbedo*****

!dump marble entrance*****

!dmpent1 1 1 6 0. -198.736 1900.785 60. 60. 10. ! marble US

!dump marble entrance*****

!dump concrete backscatter entrance*****

!dmpent2 2 0 1 0. -274.32 2612.41 5.08 60. 20. ! concrete blocker

!dump concrete backscatter entrance*****

!dumpcore*****

dumpcore 1 0 6 0. -259.08 2565.423 91.44 91.44 152.4 1 1 ! dumpcore

!end of dumpcore*****

!dumpconc*****

dumpconc 1 0 1 0. -274.32 2473.983 121.92 121.92 335.28 1 1 ! dumpconc

!end of dumpconc*****

!main vacuum pipe detector

!maindet 2 0 7 0. -60.96 3075.76 0. 5.08 30. 1 1 ! main pipe detector

maindet 2 0 7 0. -60.96 3041.2 0. 5.08 30. 1 1 !main pipe detector moved 3'

!end of main vacuum pipe detector

!beamstop 1 *****

b1stop 1 0 8 0. -60.96 733.993 5.715 3.81 150.134 1 1 1 ! bstop 1 STST

vacstop1 2 0 0 0. -60.96 716.213 0. 12.3952 188.087 1 1 1 ! bstop 1 vacuum

canstop1 2 0 8 0. -60.96 716.213 12.3952 12.7 188.087 1 1 1 ! beam stop can

USstop1 2 0 8 0. -60.96 713.673 4.9149 15.24 2.54 1 1 1 ! US BS1 flange

DSstop1 2 0 8 0. -60.96 904.3 4.9149 15.24 2.54 1 1 1 ! DS BS1 flange
! end of beamstop 1*****

!beamstop 2 *****
b1stop 1 0 8 0. -60.96 1167.78 5.715 3.81 150.134 1 1 1 ! bstop 2 STST
vacstop2 2 0 0 0. -60.96 1150. 0. 12.3952 188.087 1 1 1 ! bstop 2 vacuum
canstop2 2 0 8 0. -60.96 1150. 12.3952 12.7 188.087 1 1 1 ! beam stop can
USstop2 2 0 8 0. -60.96 1147.46 4.9149 15.24 2.54 1 1 1 ! US BS2 flange
DSstop2 2 0 8 0. -60.96 1338.087 4.9149 15.24 2.54 1 1 1 ! DS BS2 flange
! end of beamstop 2*****

!main vacuum pipe
mainvac 2 0 0 0. -60.96 0. 0. 4.9149 4000. 1 1 ! dump line bump air
!end of main vacuum pipe

!main vacuum pipe stainless steel
mainpip 2 0 6 0. -60.96 0. 0. 5.08 4000. 1 1 ! pipe steel
!end of main vacuum pipe stainless steel

!dump line pipe
dumpvac 2 1 0 0. -60.96 326. 0. 4.9149 2295.144 1 1 ! dump line vacuum
!end of dump line pipe

!dump line pipe stainless steel pipe
dumppip 2 1 8 0. -60.96 326. 0. 5.08 2295.144 1 1 ! dump pipe SS
!end of dump line pipe ss

!dumpbase*****
!dumpbase 1 1 1 -93.75 -260.995 2612.41 25.7 68.6 310. 1 1 ! dumpbase
!end of dumpbase*****

!dumpmarb*****
!dumpmarb 1 1 6 0. -126.216 1915.461 68.6 5. 300. 1 1 ! dump side marble
!end of dumpmarb*****

!TLM!
TLM 2 0 7 114.3 0. 0. 0.0 7.62 4000.0 40 1
!end of TLM

!shield - changed shield wall width to check it without a labyrinth
!shield 1 0 1 0. 30.48 2740. 121.92 182.88 365.76 1 1 1 !M4 shield wall
!shield 1 0 1 0. 0. 2740. 121.92 152.4 365.76 1 1 1 !M4 shield wall

!shield 1 0 1 0. 0. 2740. 121.92 152.4 457.2 1 1 1 !15 foot M4 shield wall
shield 1 0 9 0. 0. 2614. 121.92 152.4 457.2 1 1 1 !15 foot M4 shield wall
! end of shield wall

!supshield - adjacent to US dump in main aisle
supshield 1 0 10 0. -137.16 2473.983 121.92 15.24 140.017 1 1 1 !1' x 5' sup shield
!supshield - adjacent to US dump in main aisle

!shield wall detector - moved detector 25' DS for shield wall check.
shielddet 1 0 7 -114.3 68.58 6550. 236.22 220.98 30. 2 1 1 !end of enclosure detector
!end of shield wall detector

!labyrinth detector - changed detector to GTIL for shield wall check
!labydet 1 0 5 0. 167.64 3105.76 121.92 15.24 152.4 8 1 5 !labyrinth detector
!end of labyrinth detector

!shield enclosure bump - changed material from air to GTIL for shield wall check
!wallbump 1 0 3 0. 259.08 2587.6 121.92 106.68 670.56 1 1 1 !shield enclosure bump
!wallbump 1 0 5 0. 259.08 2587.6 121.92 106.68 670.56 1 1 1 !shield enclosure bump
!end of shield enclosure bump

!stage 1 particle surface *****
particles 2 0 0 0. 0. 2473.983 0. 600. 0.001 1 1 1 !artificial surface for particles
!end of stage 1 particle surface *****

!m4 enclosure 10 feet wide*****
enclair 1 0 3 0. 0. 0. 121.92 152.4 4548.48 1 1 ! m4 enclosure air
!enclair 1 0 3 0. 0. 0. 121.92 152.4 4548.48 1 1 !extend m4 enclosure air
!end of m4 enclosure*****

!m4 enclosure main level to 15.5 feet wide*****
menclair 1 0 3 0. 83.82 4548.48 121.92 236.22 731.52 1 1 !14.5' wide m4 enclosure air
!end m4 enclosure main level to 15.5 feet wide*****

!m4 enclosure at drop first 12 feet in z *****
dropenc12 1 0 3 -114.3 83.82 5280. 236.22 236.22 365.76 1 1 !15.5' wide at drop air
! end of m4 enclosure at drop first 12 feet in z

!m4 enclosure remainder

remenc 1 0 3 -114.3 68.58 5645.76 236.22 220.98 954.24 1 1 !14.5' wide at drop air

!end of m4
enclosure*****

!dump line bump out
1*****
bumpair1 1 0 3 0. -274.32 1483.65 121.92 121.92 1310.64 1 1 ! dump line bump air 1
!end of dump line bump out 1*****

!dump line bump out
2*****
bumpair3 1 0 3 0. -198.12 173.01 121.92 45.72 1310.64 1 1 ! dump line bump air 2
!end of dump line bump out 2*****

!leg 1 shield wall bypass*****
leg1air 1 0 3 0. 304.8 1947.4 121.92 152.4 152.4 1 1 ! leg 1 bypass air
!end of leg 1 shield wall bypass*****

!leg 2 shield wall bypass*****
leg2air 1 0 3 0. 381. 2099.8 121.92 76.2 1066.8 1 1 ! leg 2 bypass air
!end of leg 2 shield wall bypass*****

!leg 3 shield wall bypass*****
leg3air 1 0 3 0. 304.8 3166.6 121.92 152.4 152.4 1 1 ! leg 3 bypass air
!end of leg 3 shield wall bypass*****

!remainder is gtil
!world 2 0 5 0. 0. 0. 0. 600. 4000. 1 1 1 !GTIL is the remainder of the model
world 2 0 5 0. 0. 0. 0. 600. 6600. 1 1 1 !extend GTIL in the remainder of the model
!end of GTIL

TR1 0. 0. 0. 5. 0. 0.

TR16 0. 0. 0. 1.125 0. 0.

STOP

FIRST DUMP POSITION

!dumpalbedo*****
dumpalbedo 1 1 3 0. -201.35 1930.67 15. 15. 90. 1 1 ! air albedo trap

!end of dumpalbedo*****

!dumpentrance*****

dumpentr 2 1 3 0. -198.736 1900.785 0. 5.08 30. 1 1 ! air

!end of dumpentrance*****

!dump marble entrance*****

dmpent1 1 1 6 0. -198.736 1900.785 60. 60. 10. ! marble US

!dump marble entrance*****

!dump concrete backscatter entrance*****

dmpent2 2 1 1 0. -199.607 1910.747 5.08 60. 20. ! concrete blocker

!dump concrete backscatter entrance*****

!dumpcore*****

dumpcore 1 1 2 0. -207.451 2000.404 15. 15. 120. 1 1 ! dumpcore

!end of dumpcore*****

!dumpconc*****

dumpconc 1 1 1 0. -199.607 1910.747 68.6 68.6 300. 1 1 ! dumpconc

!end of dumpconc*****

!dump line pipe

dumpvac 2 1 0 0. -60.96 326. 0. 5.08 1700. 1 1 ! dump line bump air

!end of dump line pipe

!dumpbase*****

dumpbase 1 1 1 -93.75 -198.736 1900.785 25.7 68.6 310. 1 1 ! dumpbase

!end of dumpbase*****

!dumpmarb*****

dumpmarb 1 1 6 0. -126.216 1915.461 68.6 5. 300. 1 1 ! dump side marble

!end of dumpmarb*****

MARSBASE.INP

M4 shield wall 9/7/13

INDX T 3=T 4=F 5=T 10=T

CTRL 0

C RZVL 5=1.E8

C RZVL 0. 600. 2459.0 2800. 5=1.E8

C TAPE 18

NEVT 1000000

ENRG 5=1.E-12

C ENRG 8.0 5=1.E-12

C ENRG 8.0

VAR5 4=1.33E11

C IPIB 1 2.

C BEAM 0.25 0.25

C INIT 0. -65.96 0. 0. 0. 1.

C SMIN 1.E-3 5.

NLNG 1

ZSEC 6600.

NLTR 1

RSEC 600.

ZMIN 0.

MATR 'MATER.INP'

C NOBL 1

NHBK 1

STOP

*MCNP START

m1 1001 -0.006 6000 -0.030 8016 -0.500 11023 -0.010 13027 -0.030 &

14000 -0.200 19000 -0.010 20000 -0.200 26000 -0.014

m2 26000 1.0 cond=1

m3 7014 -0.746 8016 -0.240 18000 -0.013 1001 -0.001 gas=1

m4 29000 -0.51738 1001 -0.054004 8016 -0.428616

m5 26000 -0.1610 19000 -0.0282 14000 -0.1417 13027 -0.0972 &

12000 -0.1752 8016 -0.3800 1001 -0.0167

m6 26000 1.0 cond=1
m7 1001 -0.1077 6000 -0.1283 8016 -0.7266 7014 -0.0374
m8 24000 -0.19000 25055 -0.02000 26000 -0.69500 28000 -0.09500
m9 1001 -0.006 6000 -0.030 8016 -0.500 11023 -0.010 13027 -0.030 &
14000 -0.200 19000 -0.010 20000 -0.200 26000 -0.014
m10 1001 -0.006 6000 -0.030 8016 -0.500 11023 -0.010 13027 -0.030 &
14000 -0.200 19000 -0.010 20000 -0.200 26000 -0.014
*MCNP END

MATER.INP

M4 shield wall 9/7/13

1 'CONC'
2 'FE'
3 'AIR'
4 'COIL'
5 'GTIL' 2.24
6 'FE'
7 'TISS'
8 'STST'
9 'CONC'
10 'CONC'

STOP

XYZHIS.INP

M4 shield wall 9/7/13

xyz -60.96 60.96 -600. 600. 0. 6600. 1 300 300 model_slab_4ft_thick

FLT DET DEN DEG DEM DRE STA

xyz -121.92 121.92 -457.2 -426.72 2473.983 2809.263 8 1 11 DA_left_for_stars

STA

xyz 152.4 182.88 -396.24 -152.4 2473.983 2809.263 1 8 11 DA_above_for_stars

STA

xyz -182.88 -152.4 -396.24 -152.4 2473.983 2809.263 1 8 11 DA_below_for_stars

STA

xyz -121.92 121.92 -396.24 -152.4 2839.843 2870.223 8 8 1 DA_downstream_for_stars

STA

STOP