

Weekly Update - Week of 06 May 2018

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May 13, 2018

Color Coding Guide

Guide to color coding in these updates:

- Text in red are points that I really want to emphasize and would like your immediate input on as these are either major hurdles that I am currently facing, or important that I get right to ensure that analysis later on is not affected
- Text in green are questions that are outstanding that I have not been able to find an answer for, but unlike the text in red these questions these questions are not currently hindering me from progressing forward
- Text in purple are things I just want to stand out apart from my explanations. Thus, things like variable names and major advancements will be colored this way

For your convenience, please feel free to skip most of the text (as it is mostly for me to keep track of progress anyways) but if you could kindly look at what I have highlighted I would greatly appreciate it. Thanks!

1 Past Week

This **past week** I was primarily working on **two** things:

1. Start working on creating the geometry for the applicator in Lympereopoulou *et al.* (2004)

- Used the geometry given in the TG186 applicator folder of egs_brachy as a template to begin constructing the applicator
- Initially ran into some problems regarding the underlying code being unable to successfully run
 - Specifically, had problems with the code being unable to create an egsrun folder within my egs_brachy folder. Got around this by copying the file and adding “ver2” at the end of the file name and re-running. This apparently fixed it. (Still not sure what happened here)
 - * Subsequent renamings of this file did not cause it to crash
 - Also had some memory problems for a while that turned out to be an error on my part where, because of the order in which I embedded the different geometries, rather than moving the ^{192}Ir source within the applicator to the different dwell positions, it turns out I was moving the entire applicator.

- Finished constructing the geometry of the applicator and have successfully embedded the ^{192}Ir dwell positions within it.
- 2. Run initial simulations on prototype geometry**
- I embedded the applicator, centered, into a cubic water phantom with the dimensions of $(20 \text{ cm})^3$ with cubic scoring voxels of size $(2 \text{ mm})^3$.
 - The water phantom was then surrounded by 10 cm water padding on each side
 - Total simulation geometry was a cube with dimensions $(30 \text{ cm})^3$
 - This is roughly in line with Lymeropoulou *et al.* Though there it seems that they had a spherical water phantom but cubic scoring voxels? (This still doesn't make sense to me. I have to re-read the paper)
 - I also have not yet figured out how they "programmed" the location of the source dwell positions. So I tried a series of different positions to see what effects they would have and which ones most closely matched their results
 - Because my phantom geometry is much more different than what Lymeropoulou *et al.* have I am getting much more different numbers than what they report in the paper
 - Below I have attached the results from the simulations I have run thus far
 - I have run simulations for the configuration described above for an applicator with no shielding, 90° shielding, 180° shielding, 270° shielding and the results and a bit of discussion are below

2 Next Week

In the **next week** I plan on tackling the following **three** things:

1. **Continue with my readings**
 - Read about fundamentals of brachytherapy
 - Read about the relevant statistics in use clinical dosimetry
 - Read the paper by Ma *et al.* (2017)
2. **Do comparison with Suxer's results and see what is different between our simulation results**

3 Figures

A quick explanation regarding the labels:

- Here "configuration" means the different possible dwell positions that I have tried (temporary lack of a better name) they are as follows (listing the location of the dwell positions within in units of cm):
 1. Base config.: 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0
 2. Config. 2: 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5
 3. Config. 3: 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0
 4. Config. 4: 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5
 5. Config. 5: 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
 6. Config. 6: 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5
 7. Config. 7: 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5

8. Config. 8: 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0
- The midpoint of the *cylindrical* portion of the applicator is the origin.

3.1 No Shield

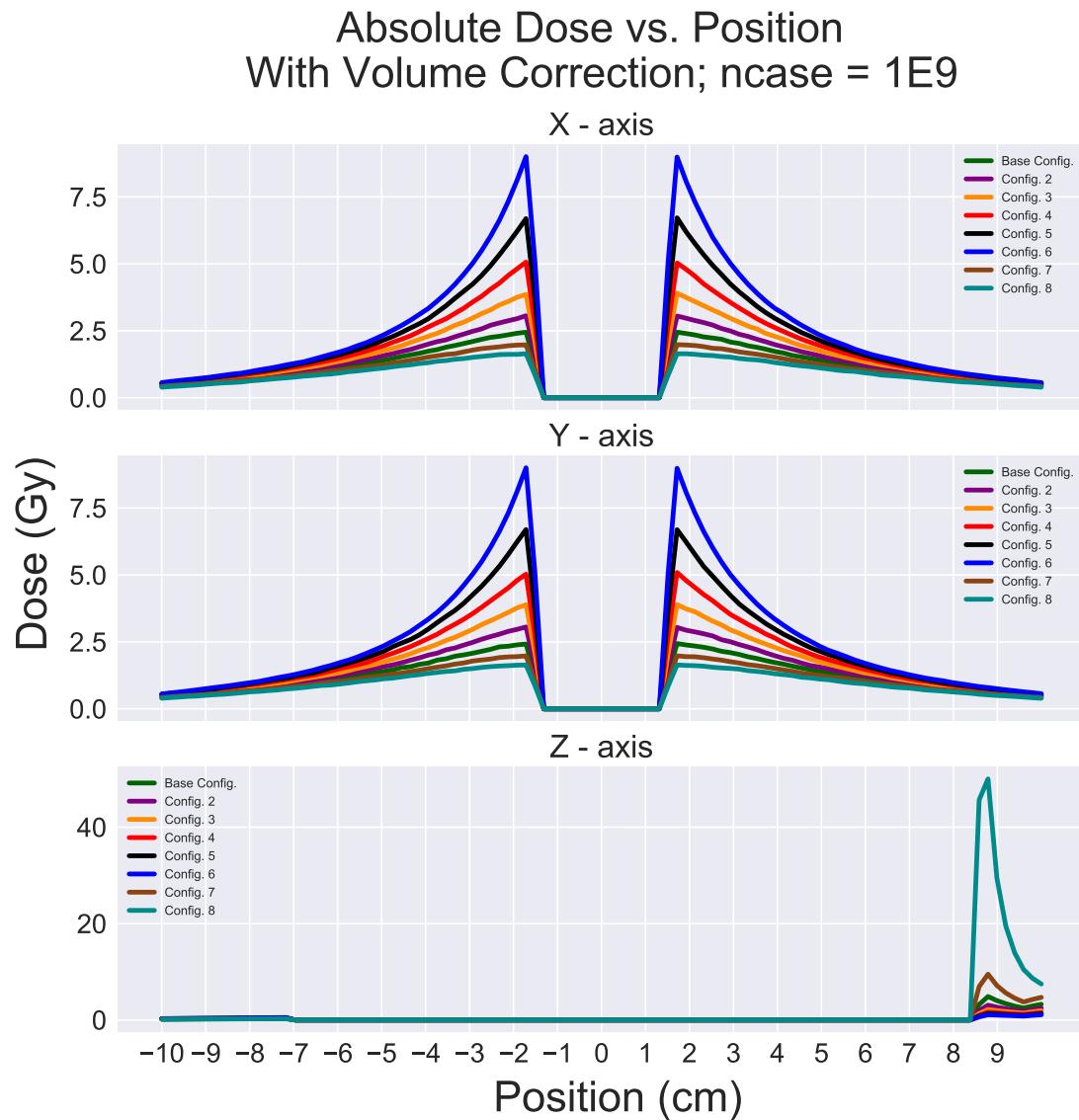


Figure 1: Absolute Dose vs. Position with respect to the coordinate planes.

Isodose Contours With Volume Correction; ncase = 1E9

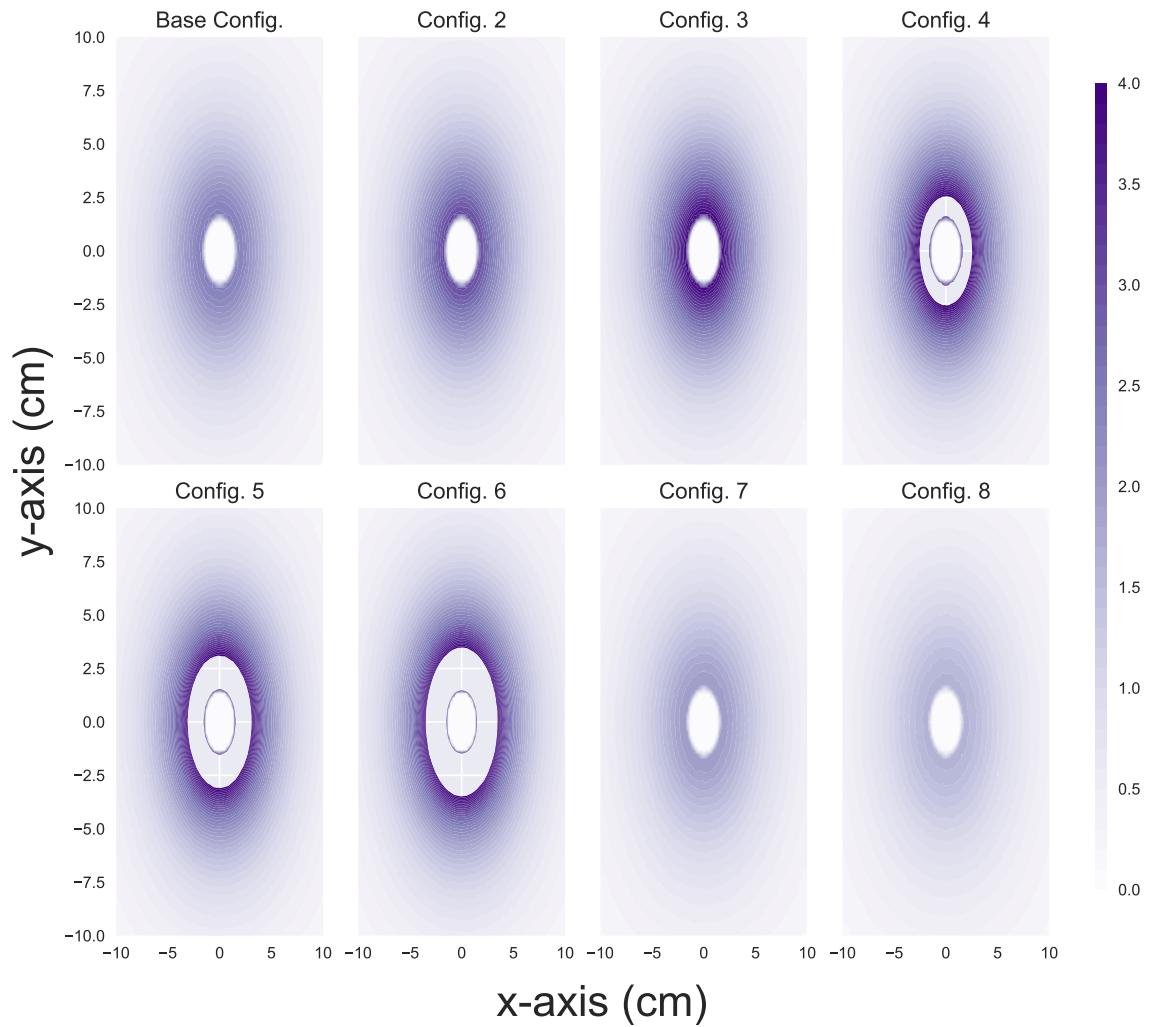


Figure 2: Isodose contours on the xy-plane.

Isodose Contours With Volume Correction; ncase = 1E9

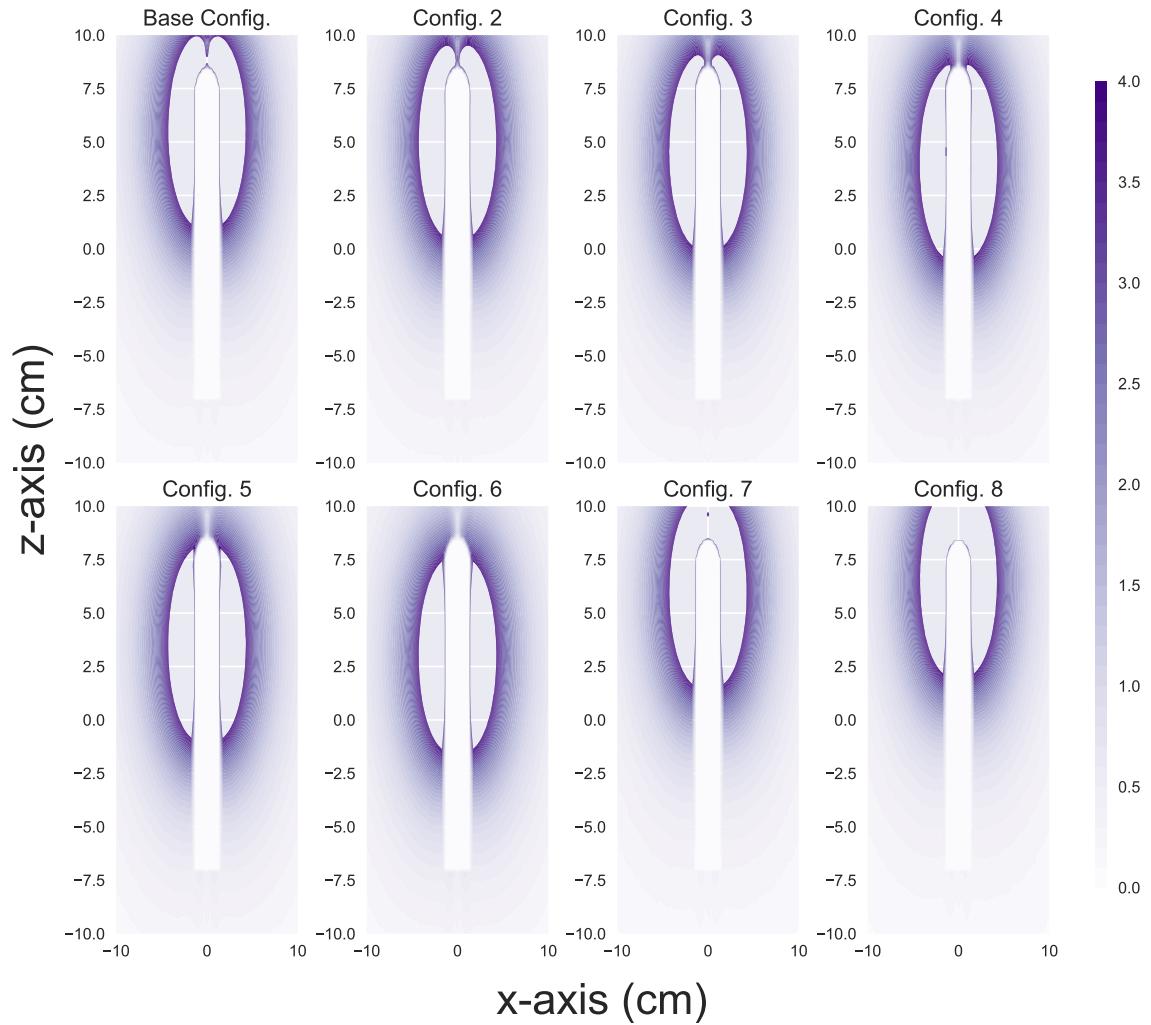


Figure 3: Isodose contours on the xy-plane.

3.2 90° shield

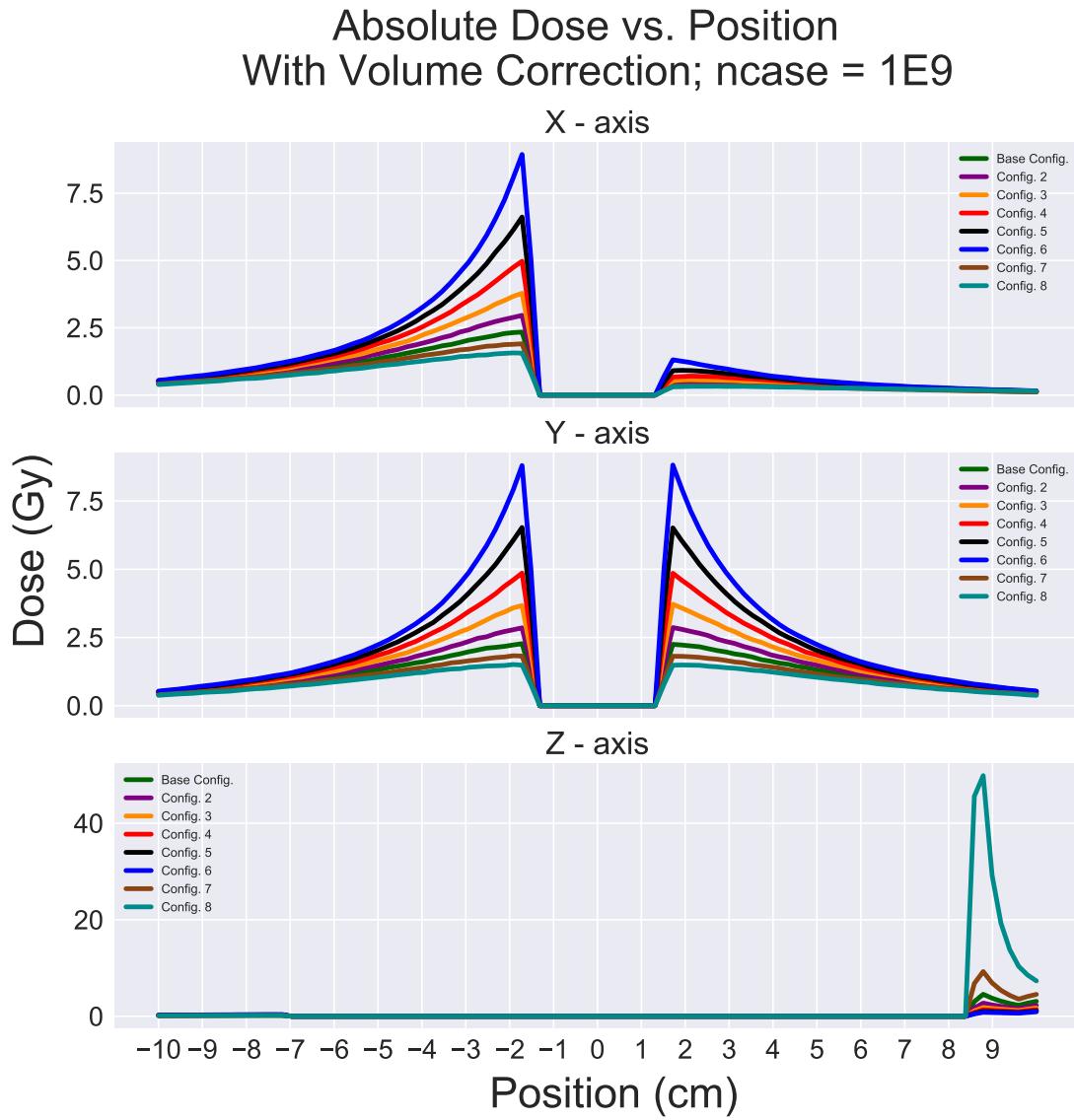


Figure 4: Absolute Dose vs. Position with respect to the coordinate planes.

Isodose Contours With Volume Correction; ncase = 1E9

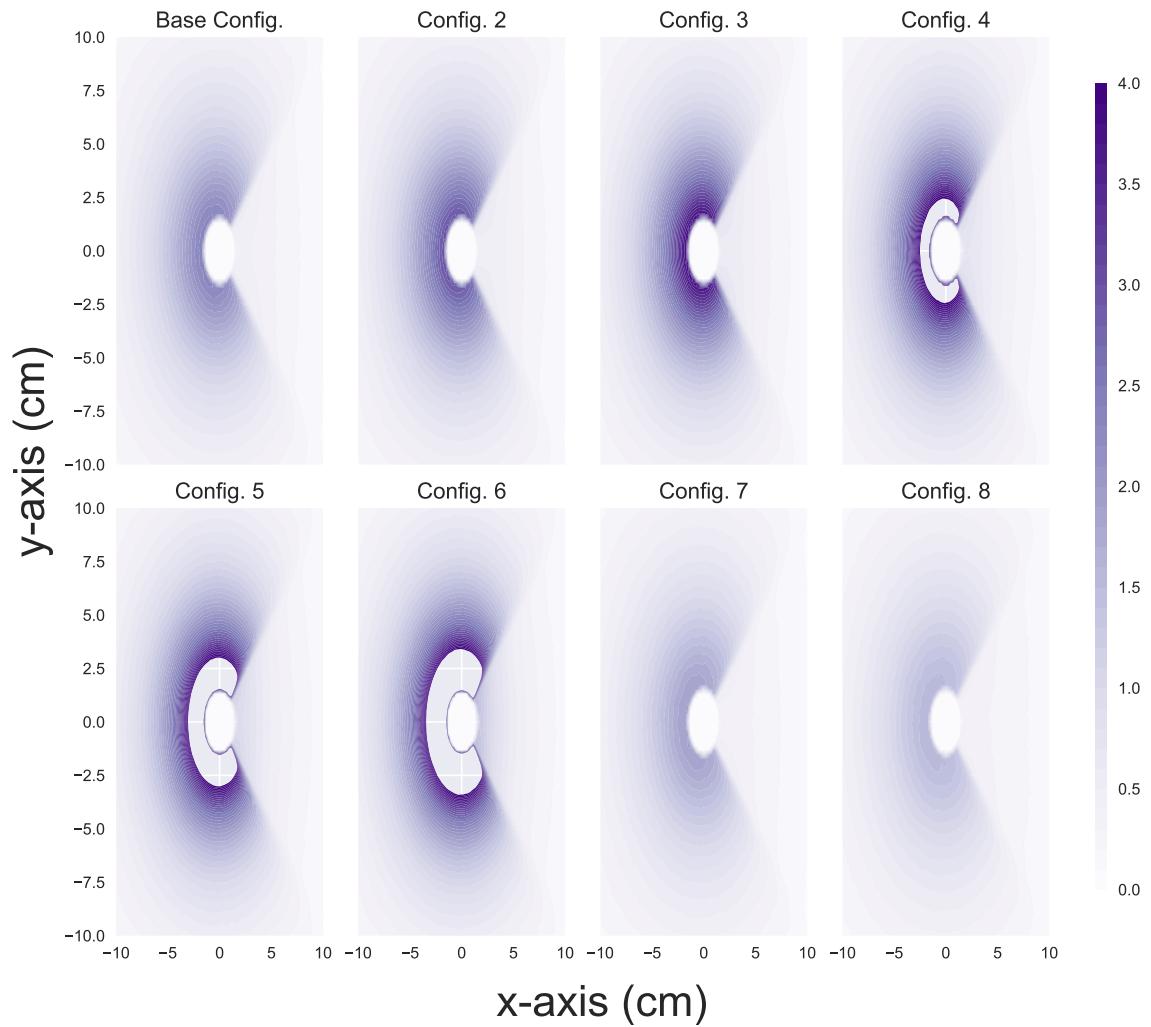


Figure 5: Isodose contours on the xy-plane.

Isodose Contours With Volume Correction; ncase = 1E9

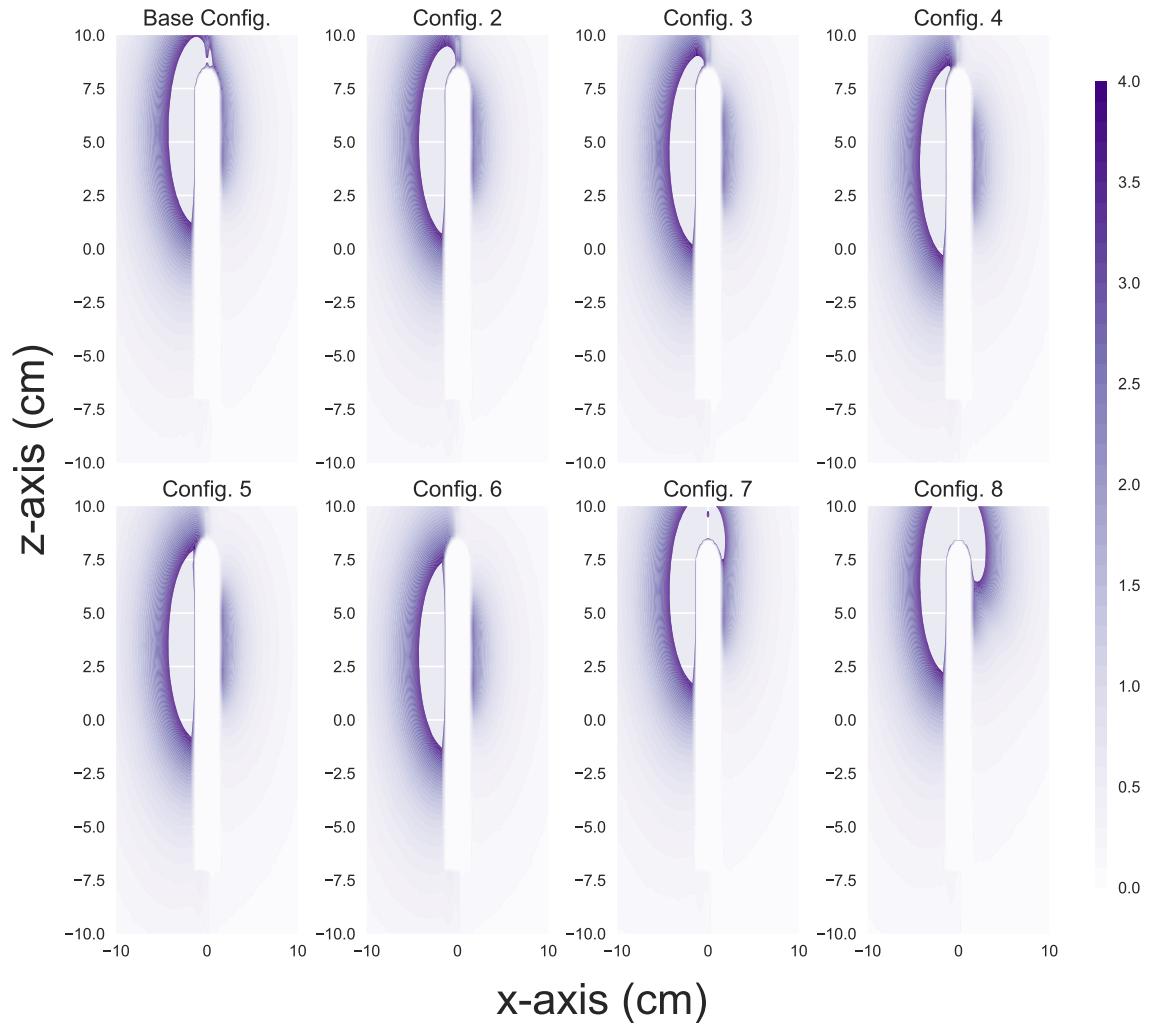


Figure 6: Isodose contours on the xz-plane.

3.3 180° shield

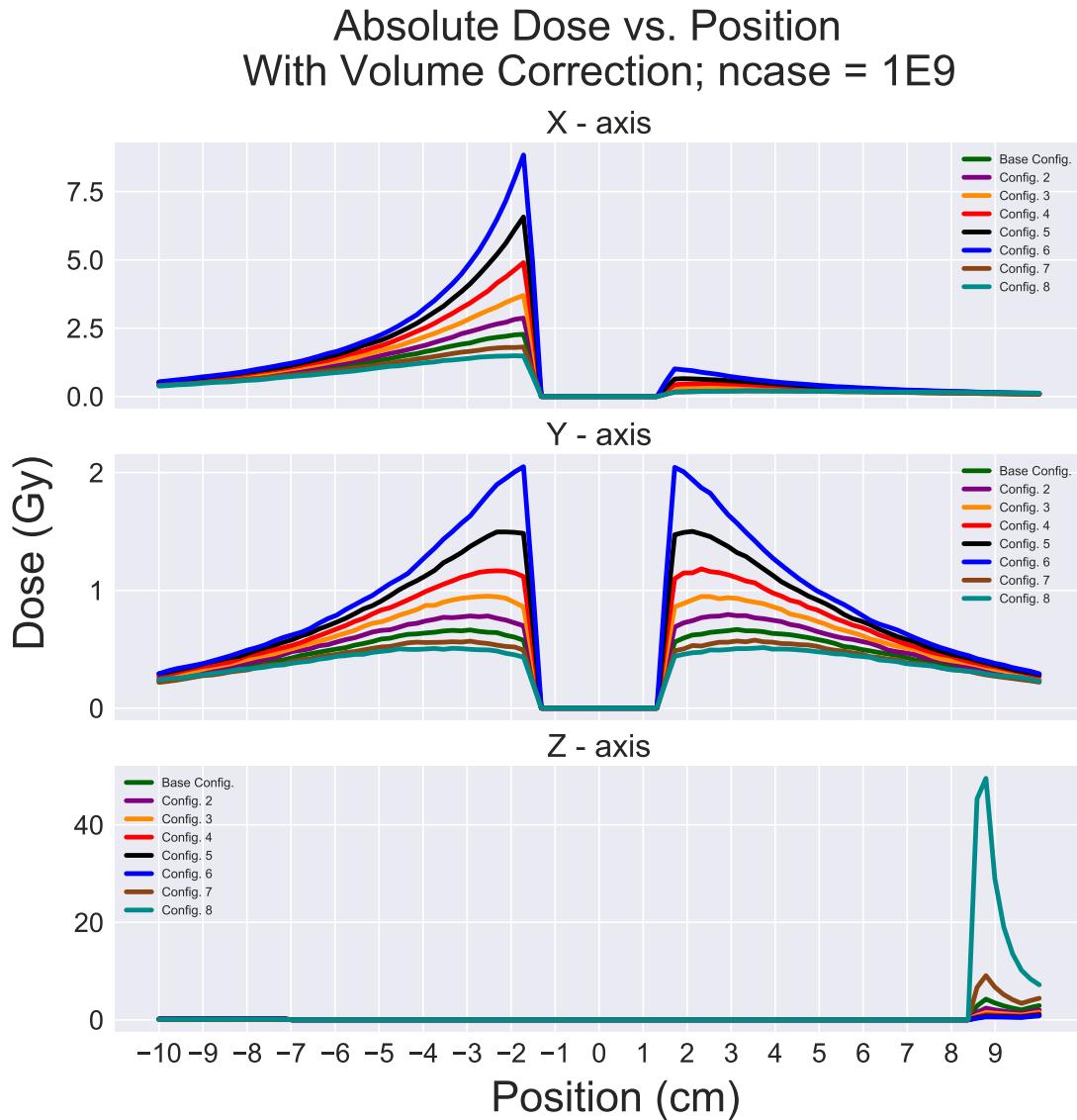


Figure 7: Absolute Dose vs. Position with respect to the coordinate planes.

Isodose Contours With Volume Correction; ncase = 1E9

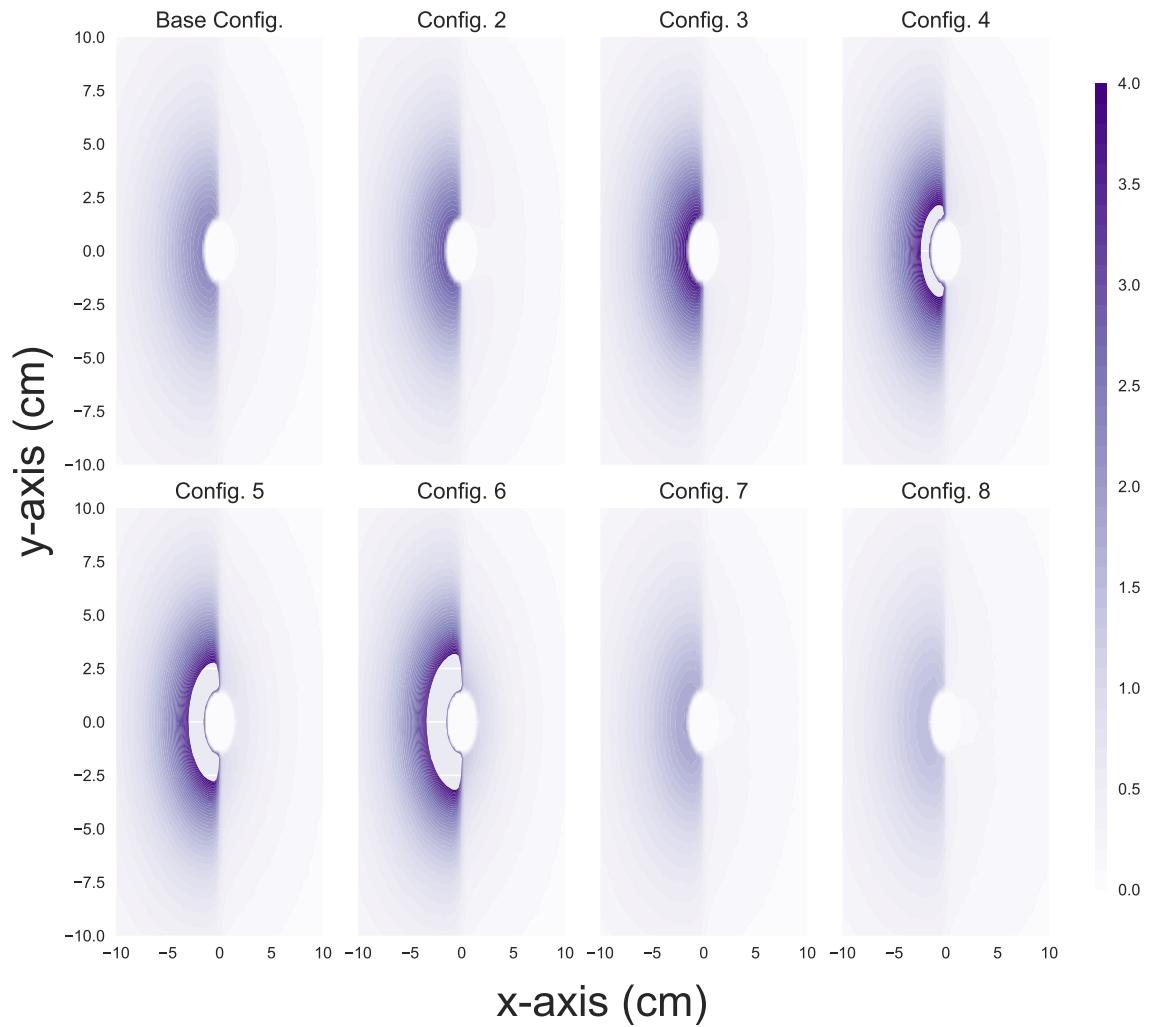


Figure 8: Isodose contours on the xy-plane.

Isodose Contours With Volume Correction; ncase = 1E9

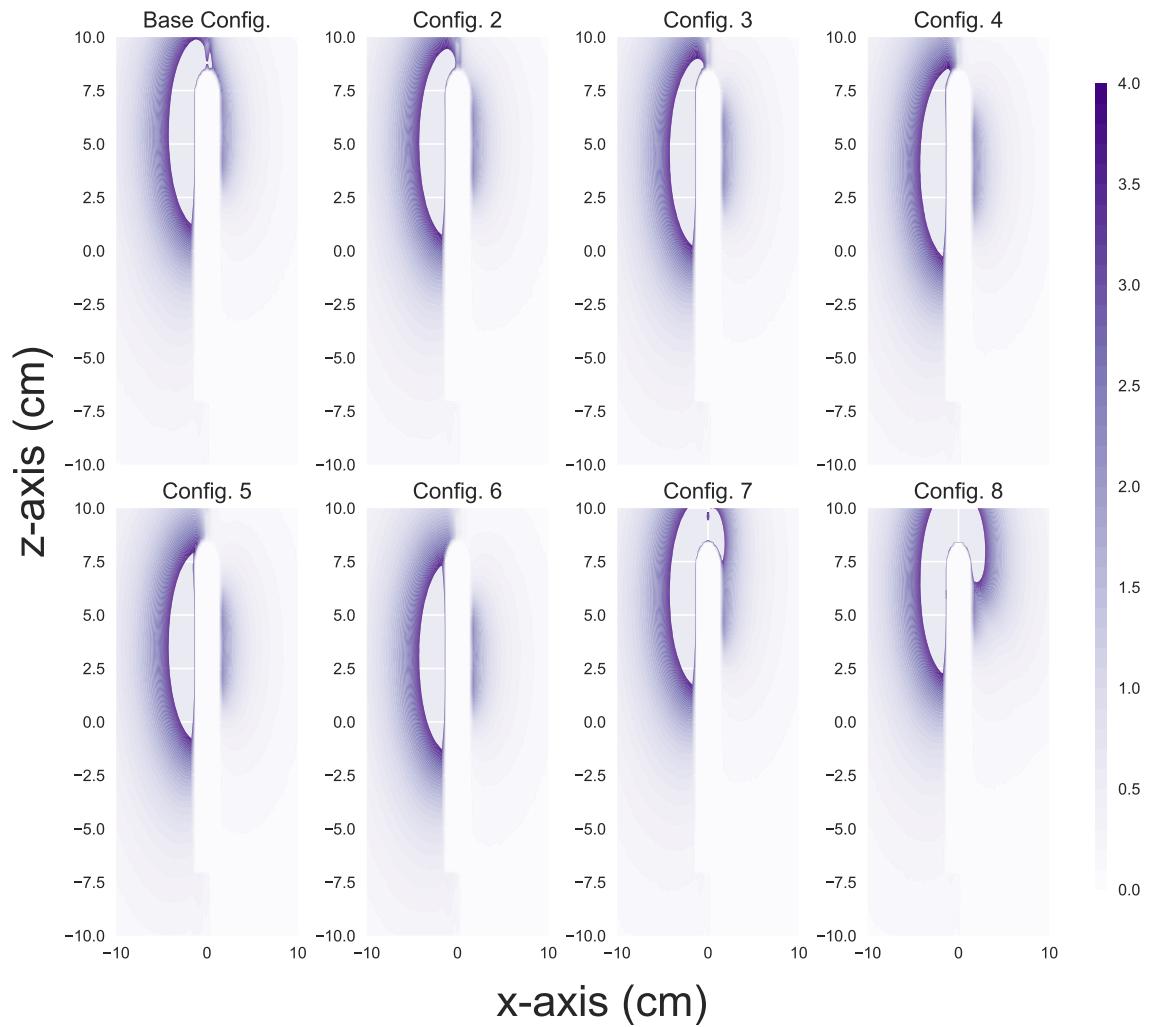


Figure 9: Isodose contours on the xz-plane.

3.4 270° shield

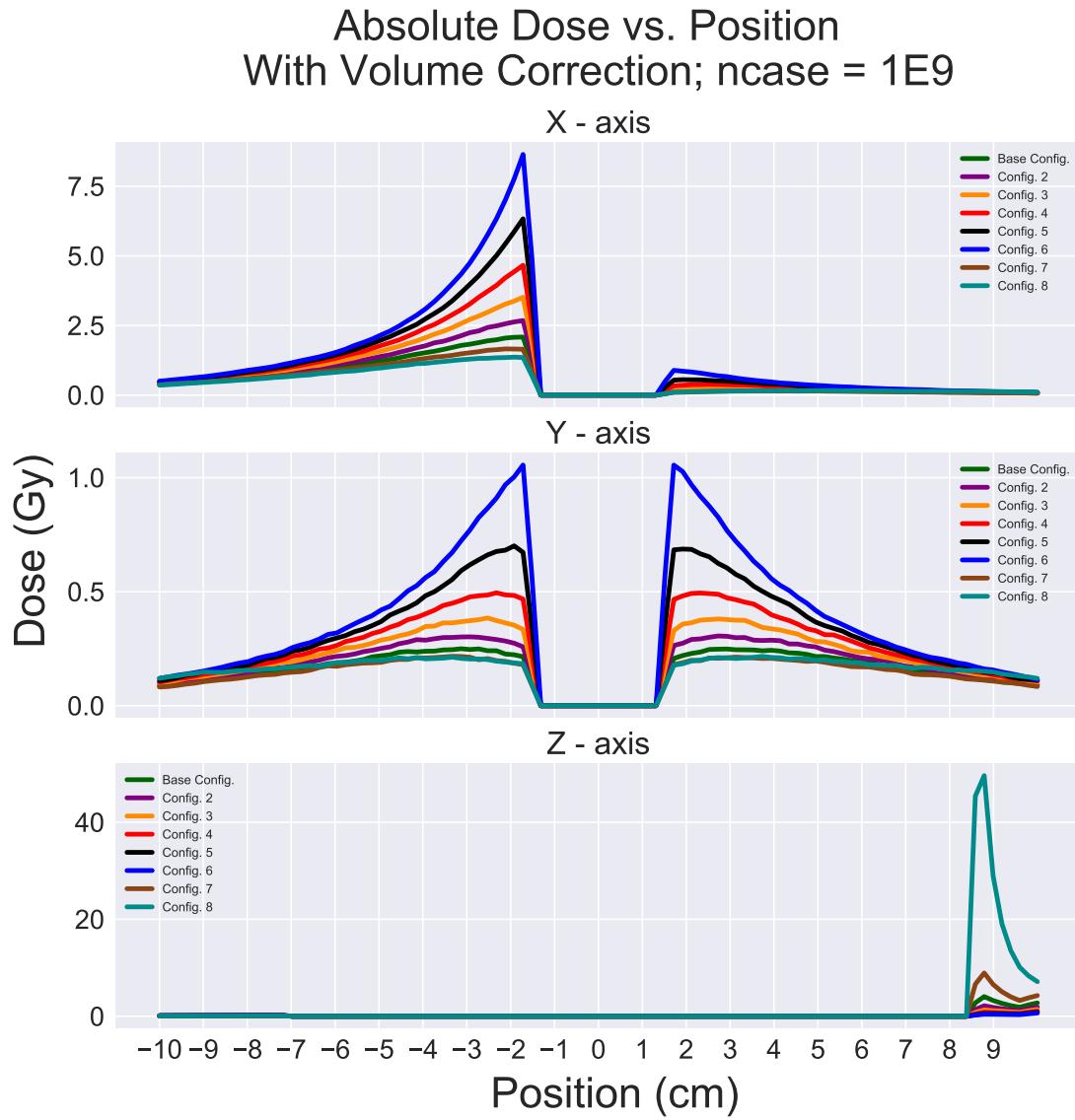


Figure 10: Absolute Dose vs. Position with respect to the coordinate planes.

Isodose Contours With Volume Correction; ncase = 1E9

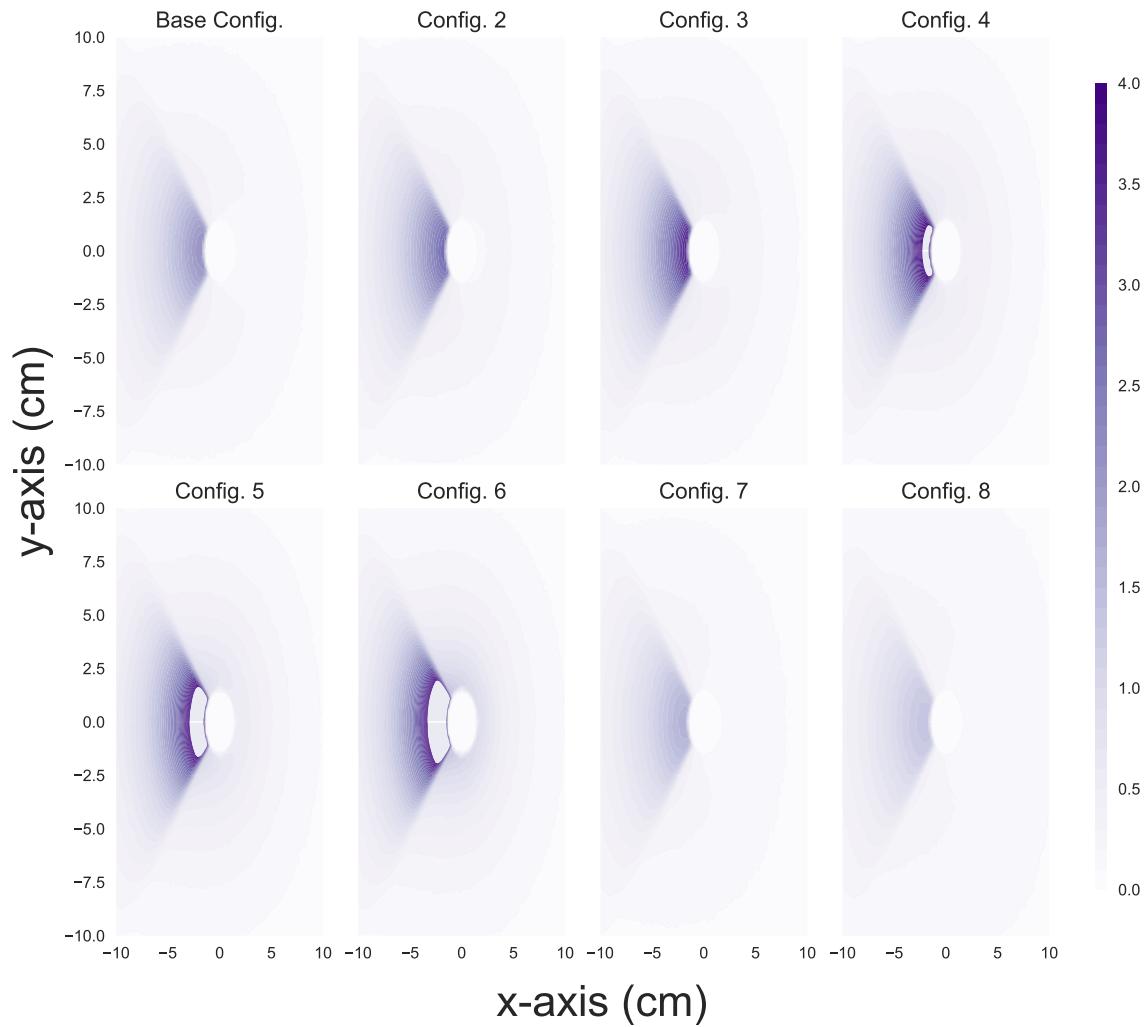


Figure 11: Isodose contours on the *xy*-plane.

Isodose Contours With Volume Correction; ncase = 1E9

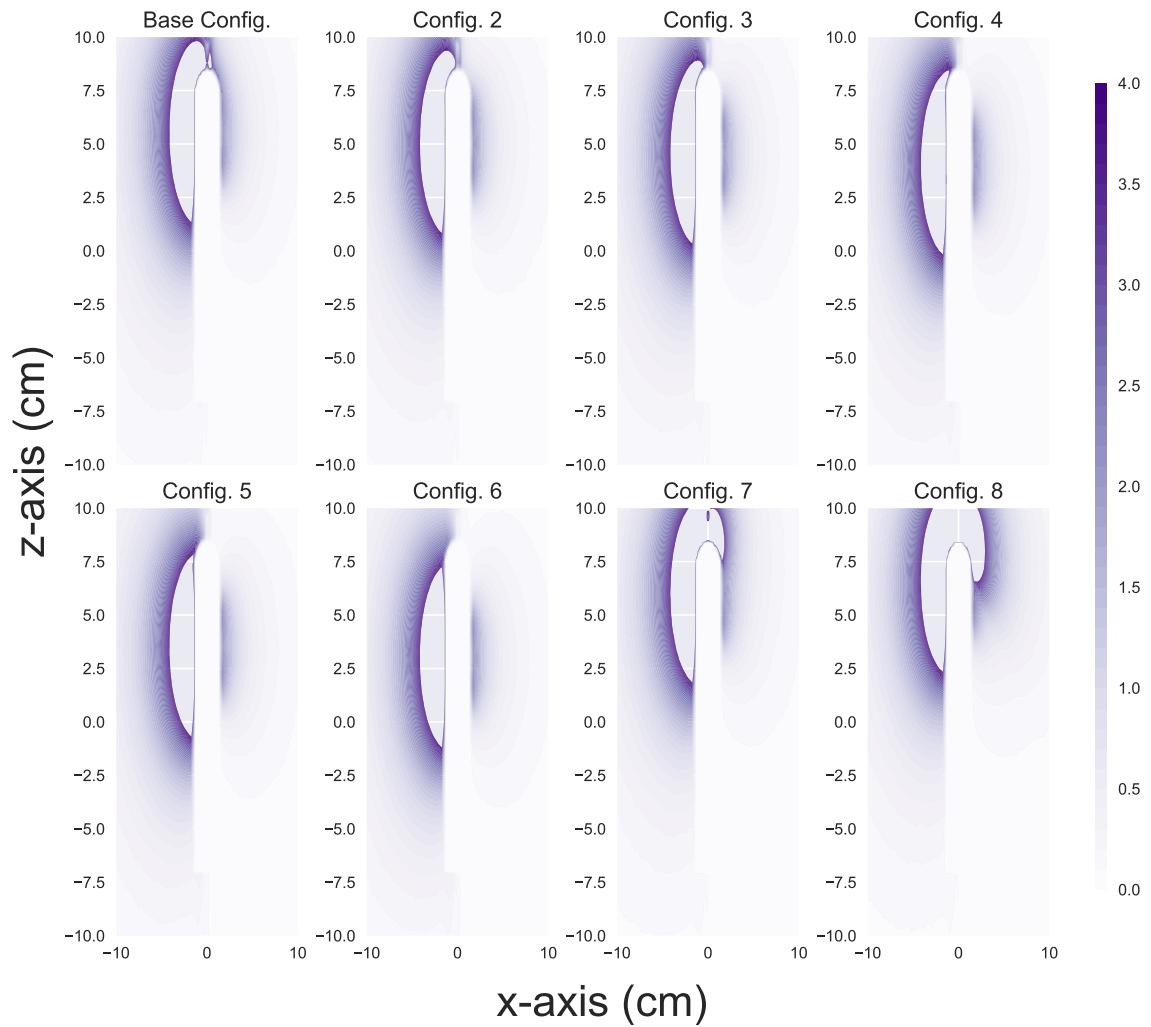


Figure 12: Isodose contours on the xz-plane.

3.5 Dose Volume Histograms

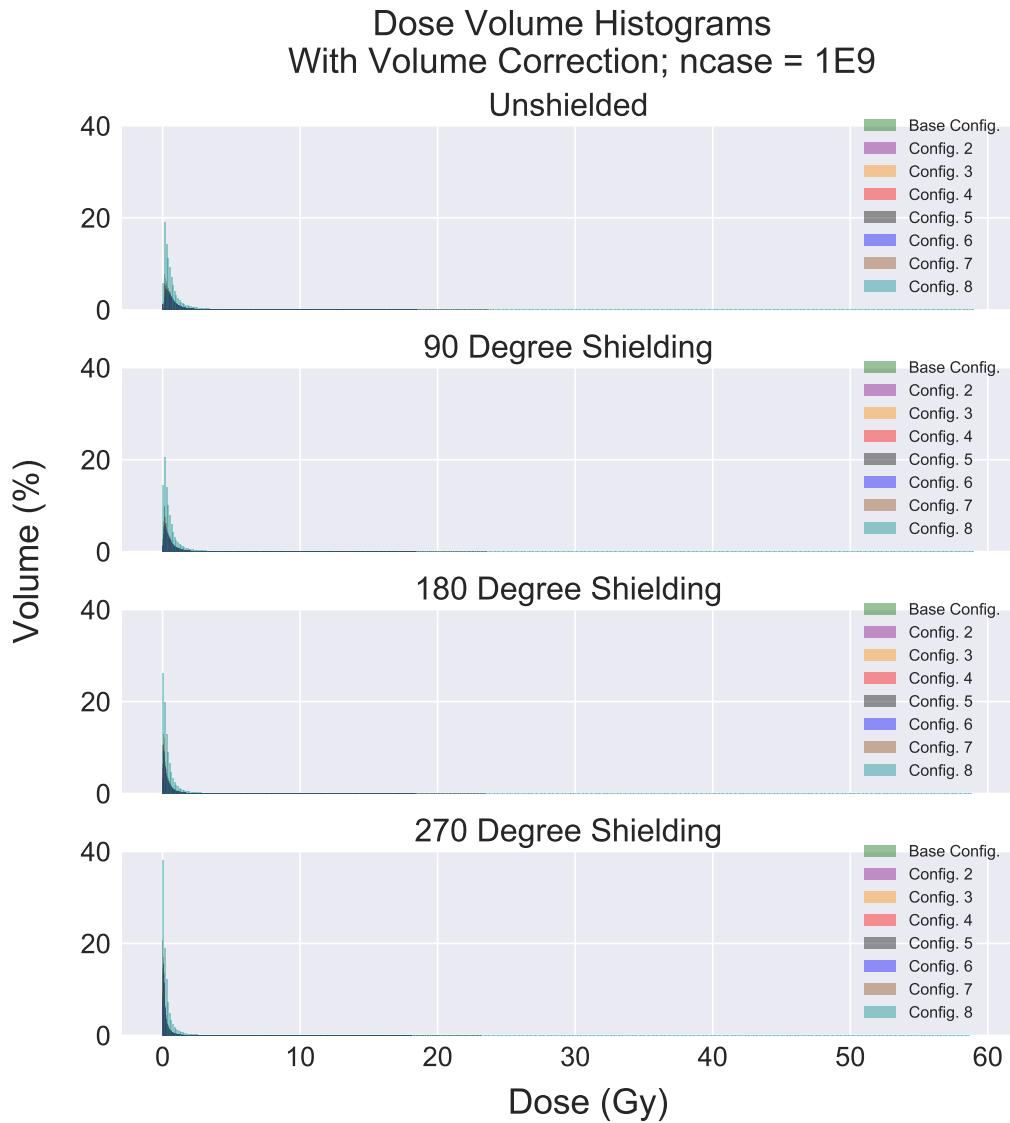


Figure 13: Absolute Dose Volume Histograms

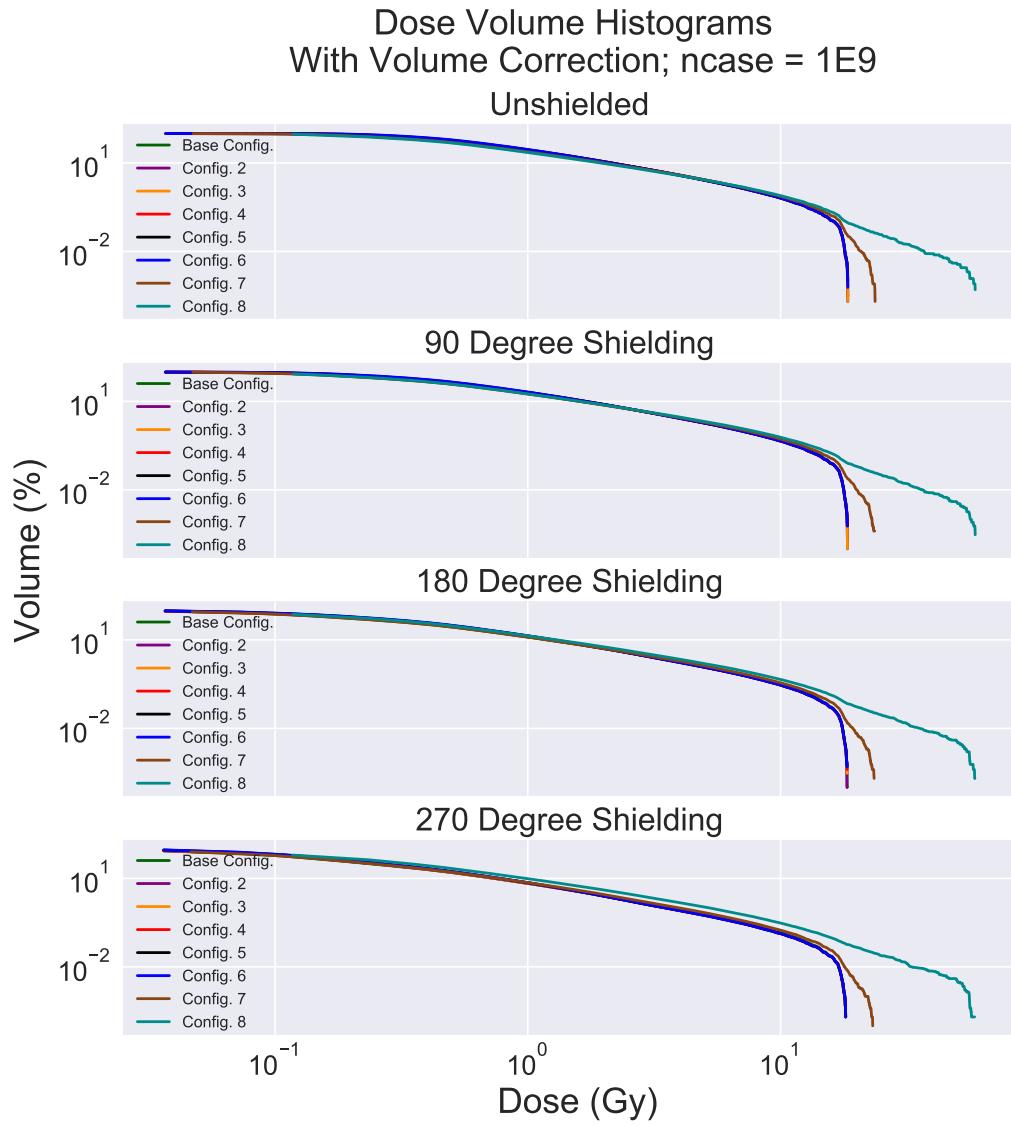


Figure 14: Cumulative Dose Volume Histograms.