



PS ROOM RESIDUAL DOSE RATE DUE TO TARGET, END CAP, HRS, AND BEAM DUMP SOURCES

8 kW beam power
365 days irradiation, 7 days cooling
A. Leveling
6/10/15

PS ROOM MODEL

Target, HRS, PS, and magnetic fields are transcribed from Vitaly's model

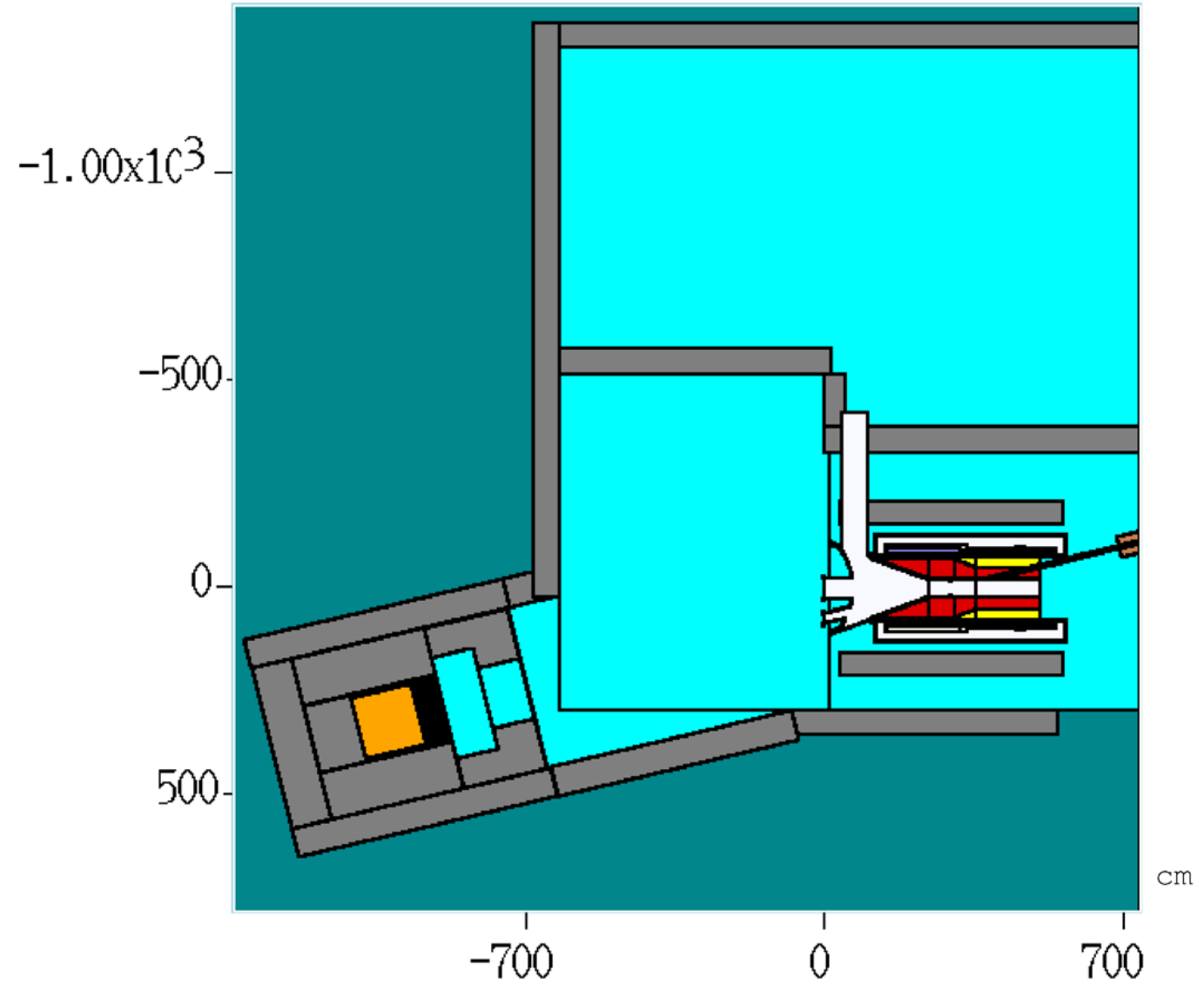
PS room, RHR room, drop hatches and beam dump constructed from FESS drawings

- With input from George Ginther, Andy Stefanik, Dave Pushka

Yoke constructed from guidance by George Ginther

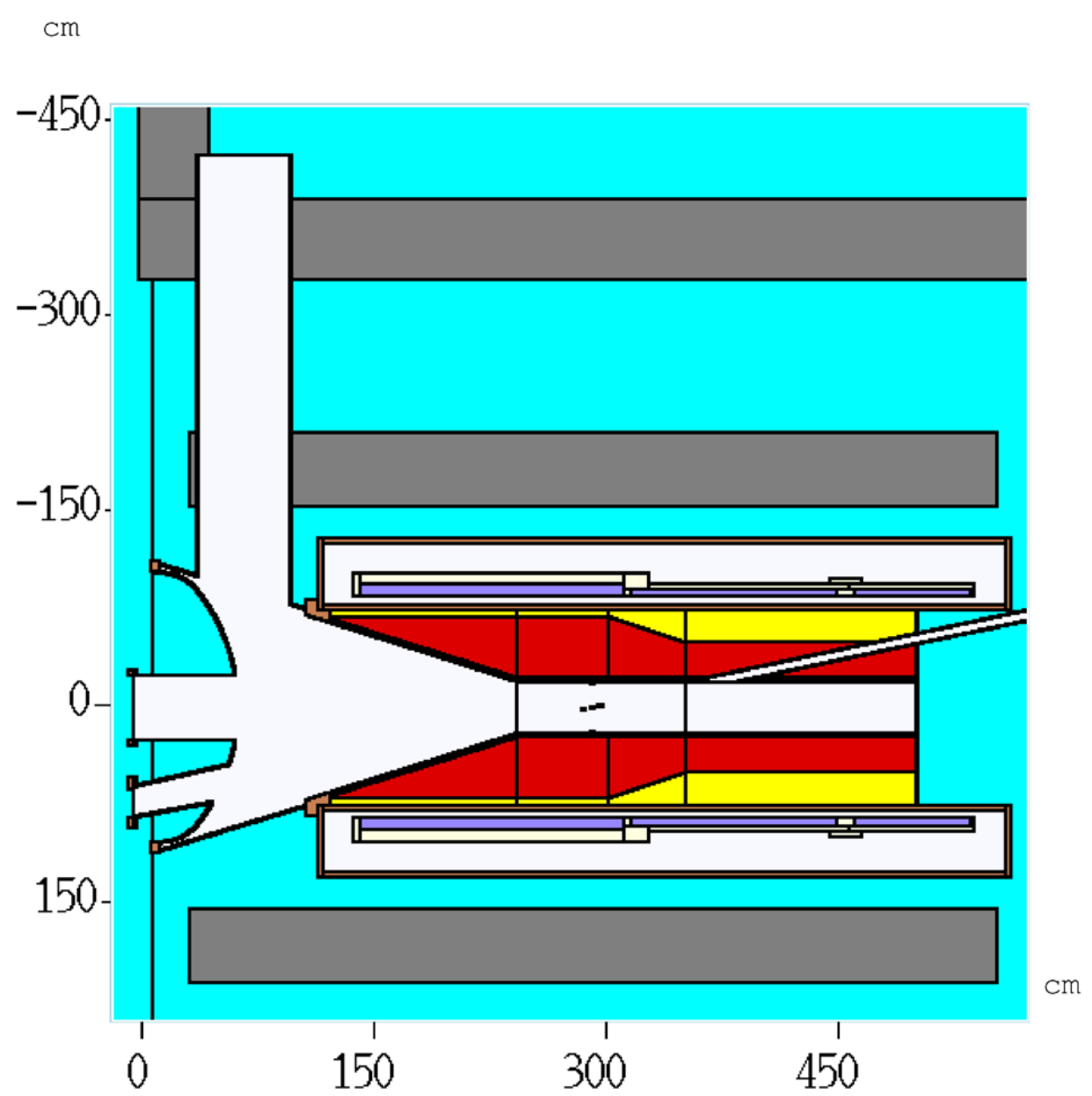
End cap constructed from input by Dave Pushka, Kurt Krempez

cm

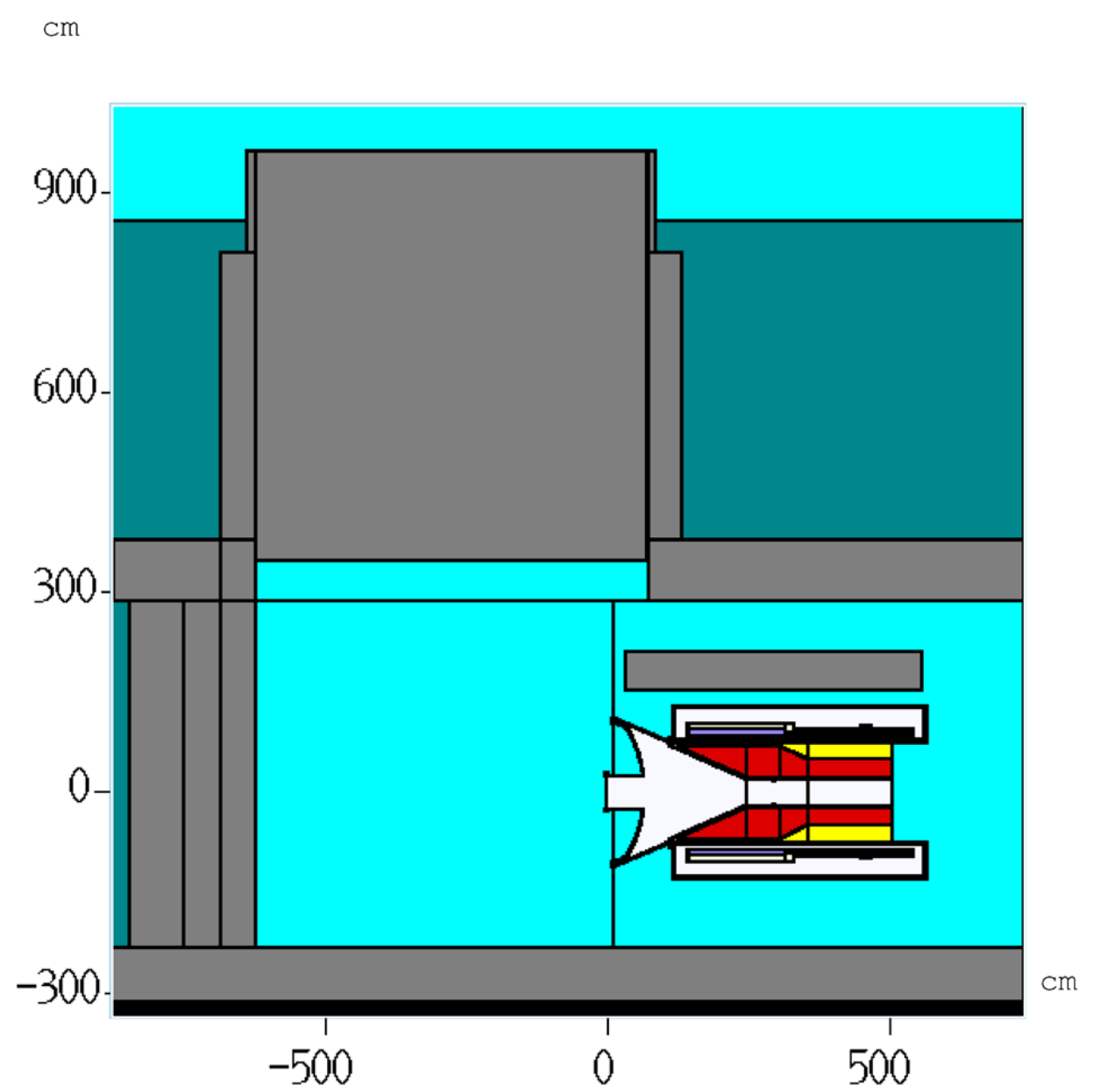


cm

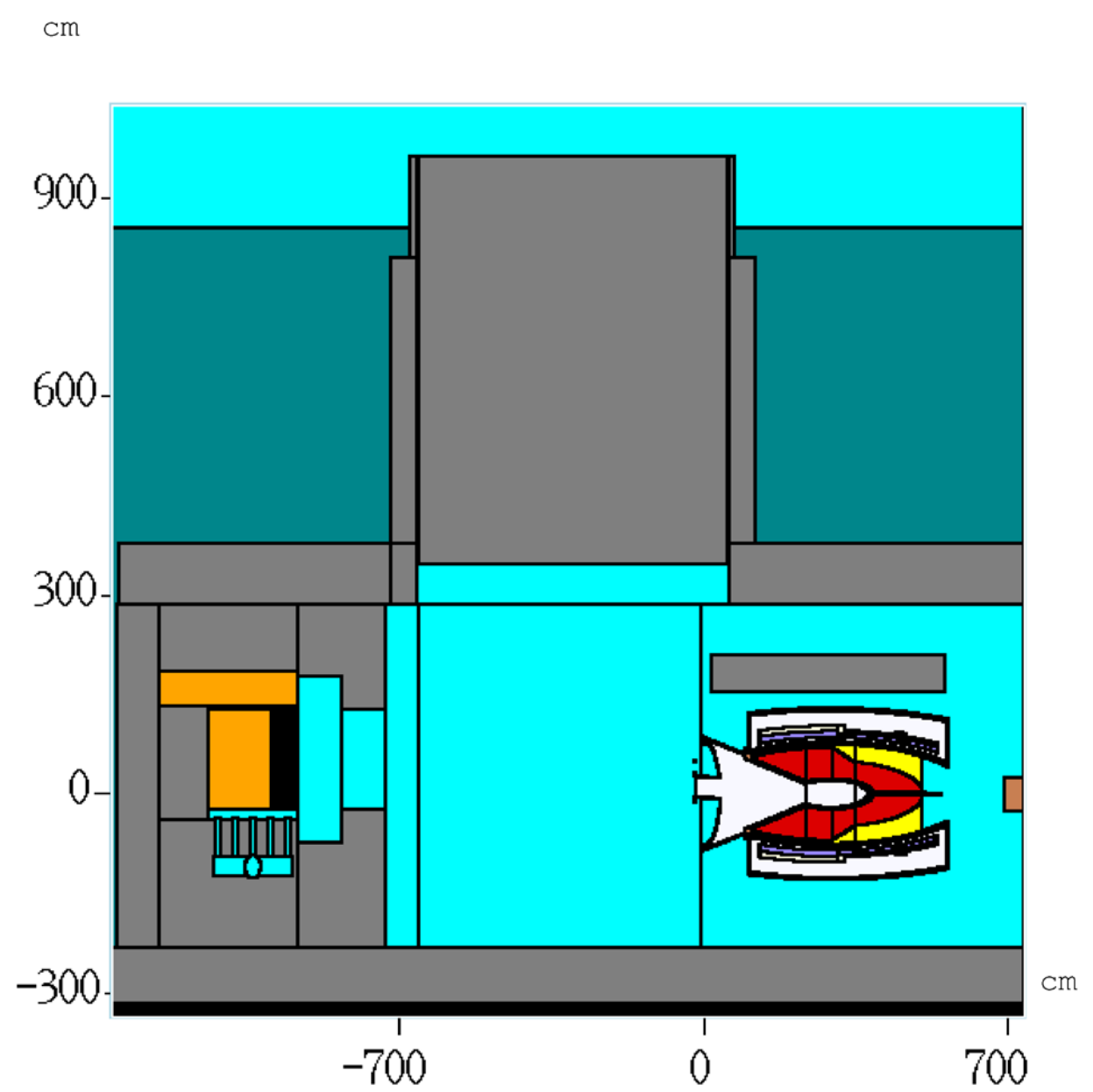
$\begin{matrix} \rightarrow z \\ \downarrow y \end{matrix}$ $y:z = 1:9.728e-01$



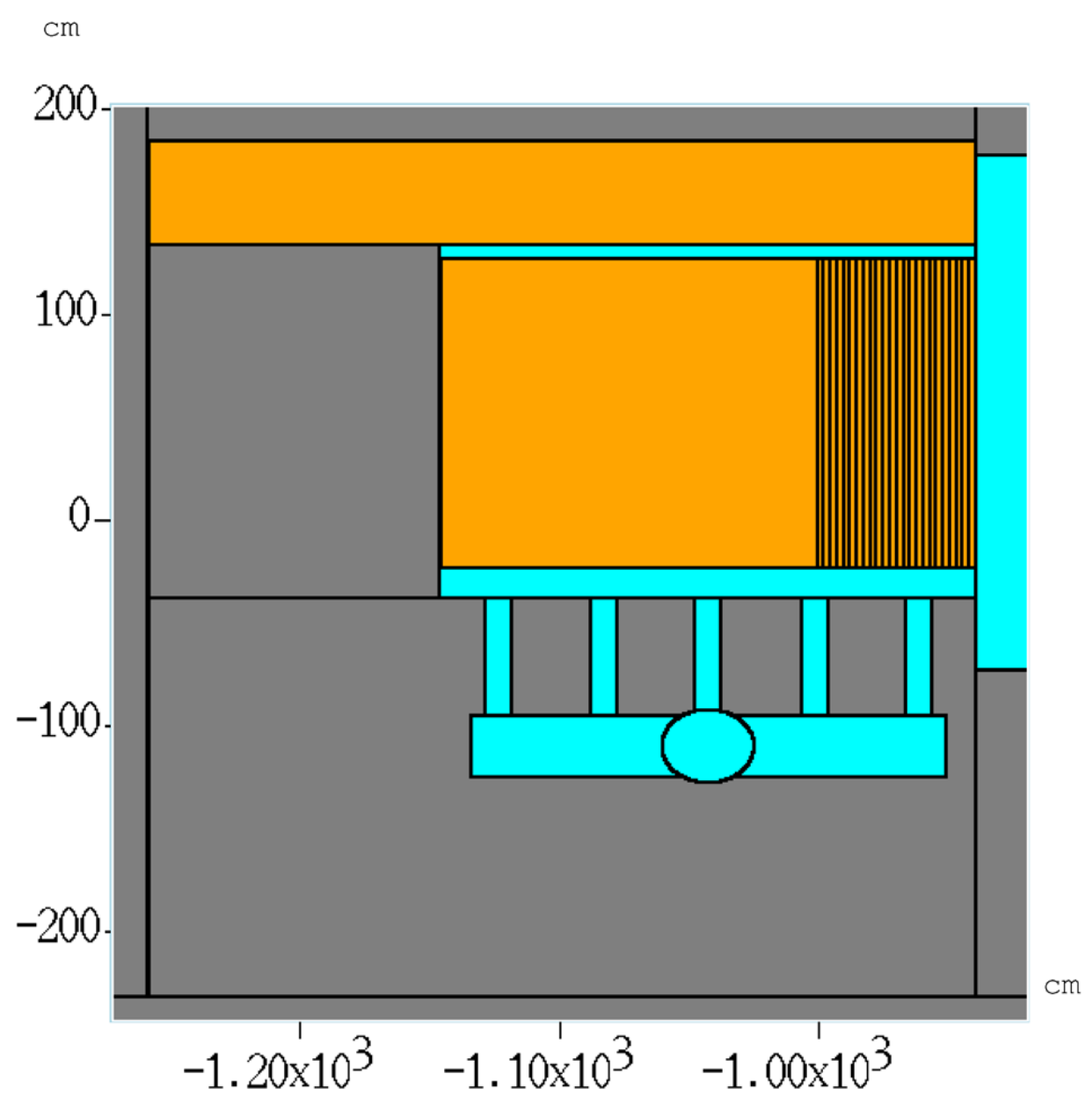
$\begin{matrix} \rightarrow z \\ \downarrow y \end{matrix}$
 $y:z = 1:8.430e-01$



x
↑
z
x:z = 1:1.184e+00

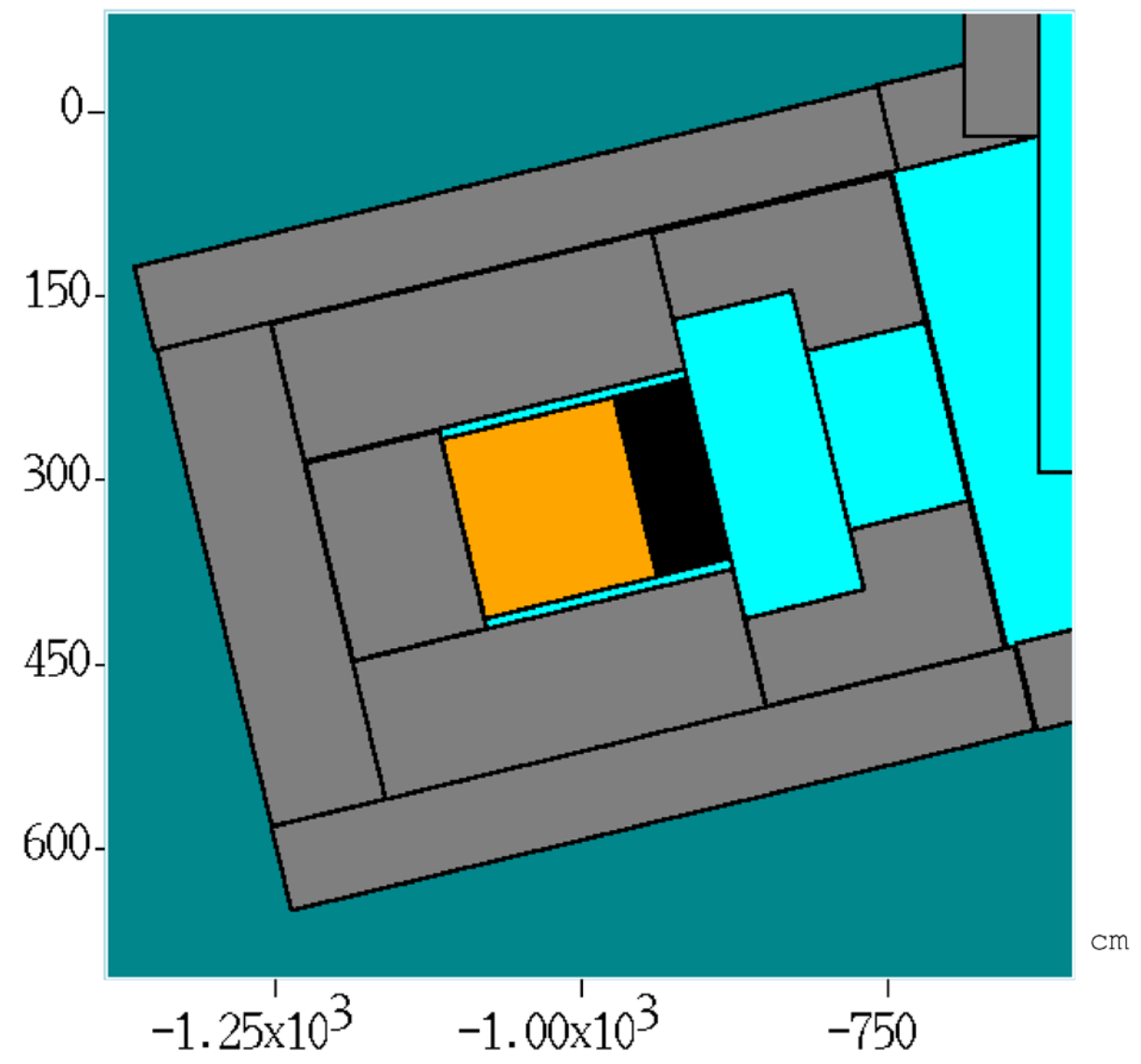


x
↑
z
→
x:z = 1:1.529e+00



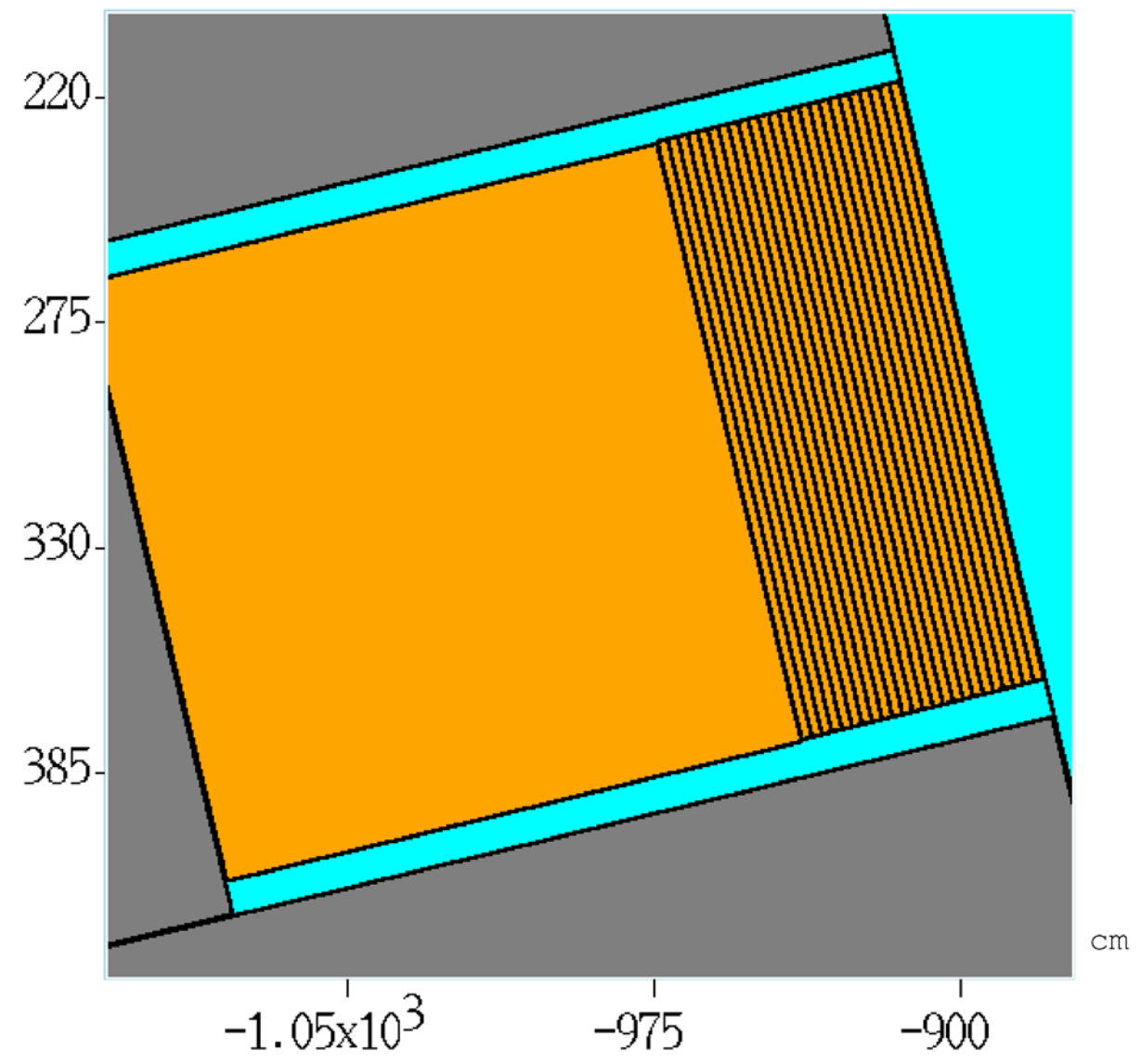
x
 ↑
 ↘ z
 x:z = 1:7.939e-01

cm



$\begin{matrix} \rightarrow z \\ \downarrow y \end{matrix}$ $y:z = 1:1.004e+00$

cm



$\begin{matrix} \rightarrow z \\ \downarrow y \end{matrix}$ y:z = 1:1.004e+00

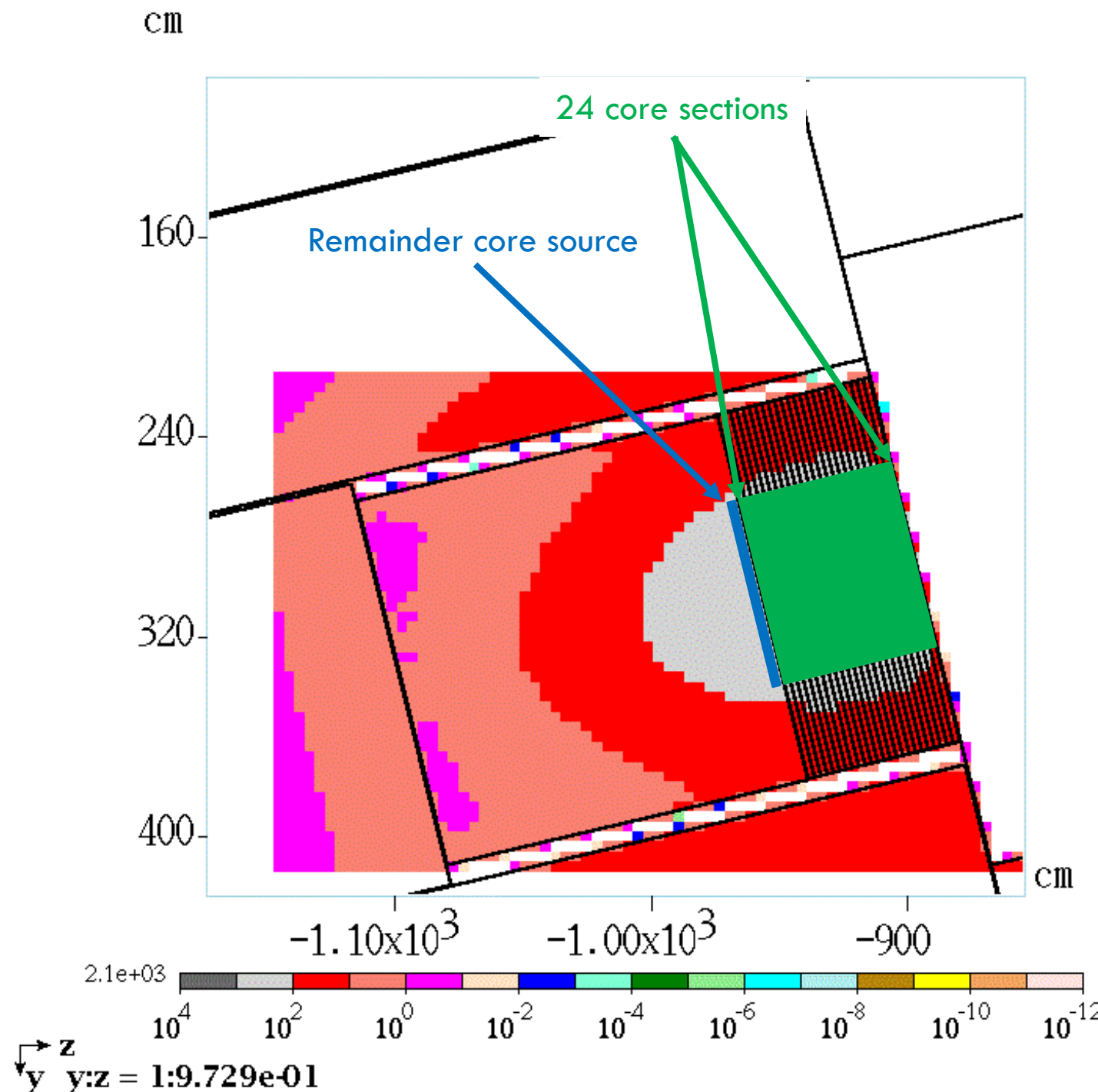
ACTIVATED COMPONENTS

Activated components include

- PS (25 sources)
 - Target
 - HRS
 - End cap
- Source development described in mu2e doc 5471-v4
- Beam dump steel core (25 sources)
 - The first 24 inches of beam dump is subdivided into 1 inch plates
 - The remainder of the dump core
- Room surfaces and structural concrete surfaces are NOT included
 - Residual dose rates of surfaces are considered individually in mu2e doc 5572-v3

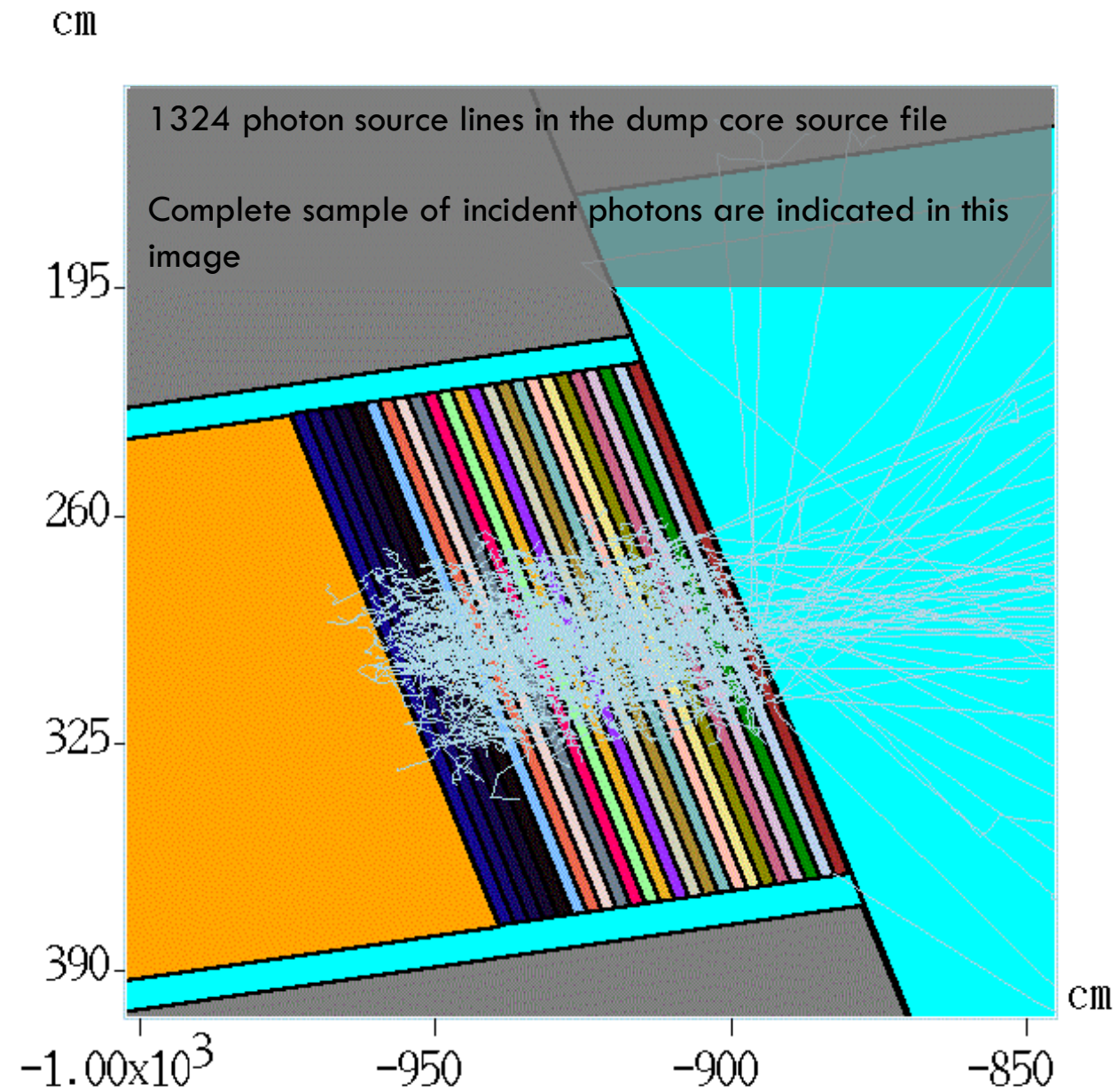
DUMP SOURCE ACTIVITY

- trial run with a residual dose rate histogram covering the dump core to determine the division of source terms
- 24 core sections
 - First 24 are 1 inch thick
 - Total activity for each plate is evenly distributed in 2 foot diameter disk at center of plate.
- Remainder core source
 - Treated as one source
 - Total activity of entire block is evenly distributed in 2 foot diameter disk at 1/2" from the end on the PS side
 - Very conservative approach!

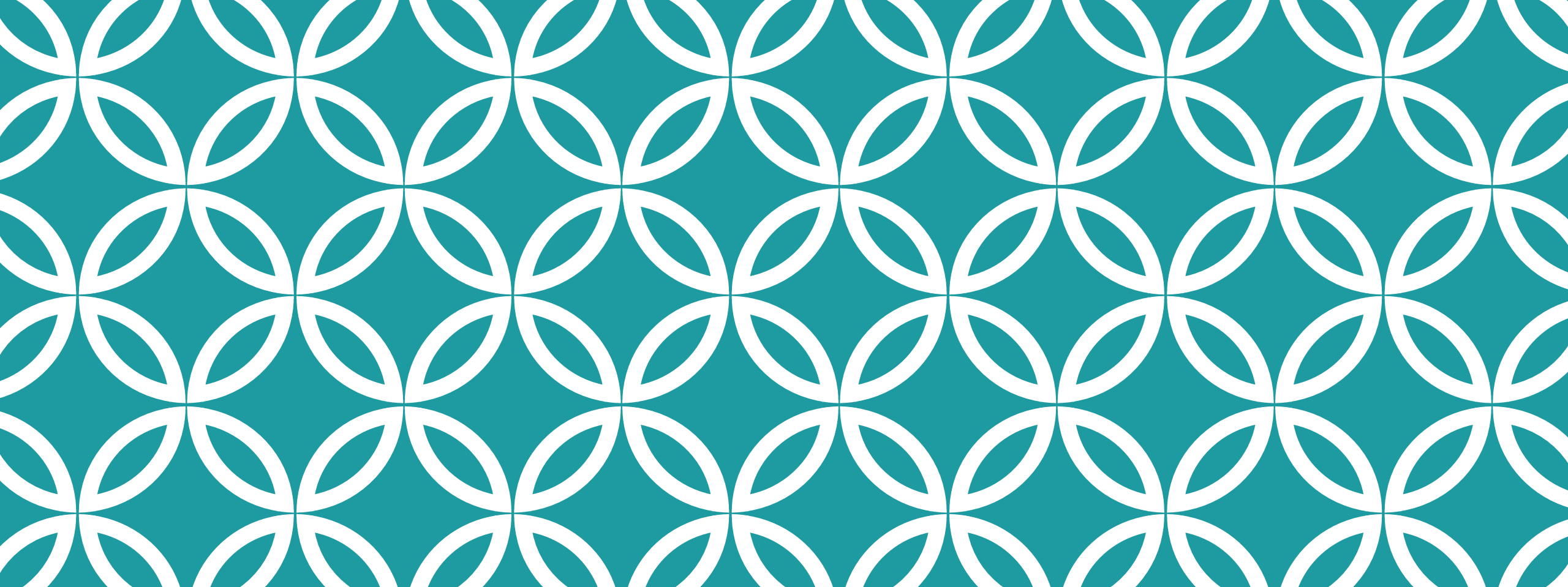


DUMP SOURCE ACTIVITY

- MARS-DETRA used to determined inventory of isotopes for each plate
- In stage 1
 - NUCLIDE files for each plate are generated
 - Requires significant cpu time to generate source term
- Isotopes and activities are generated in post stage 1 MARS runs
- A library of isotopes with associated photon energies and branching ratios was developed in earlier work
- A Fortran script is used to add photon energies and branching ratios to the list of isotopes generated by MARS-DETRA
- Preparation for stage 2
 - Distribution function is written for each source in subroutine beg
- In stage 2, MARS-EGS5 is used to calculated residual dose rate in the space
 - Uses the combined PS & dump photon sources
 - Uses combined source distribution functions



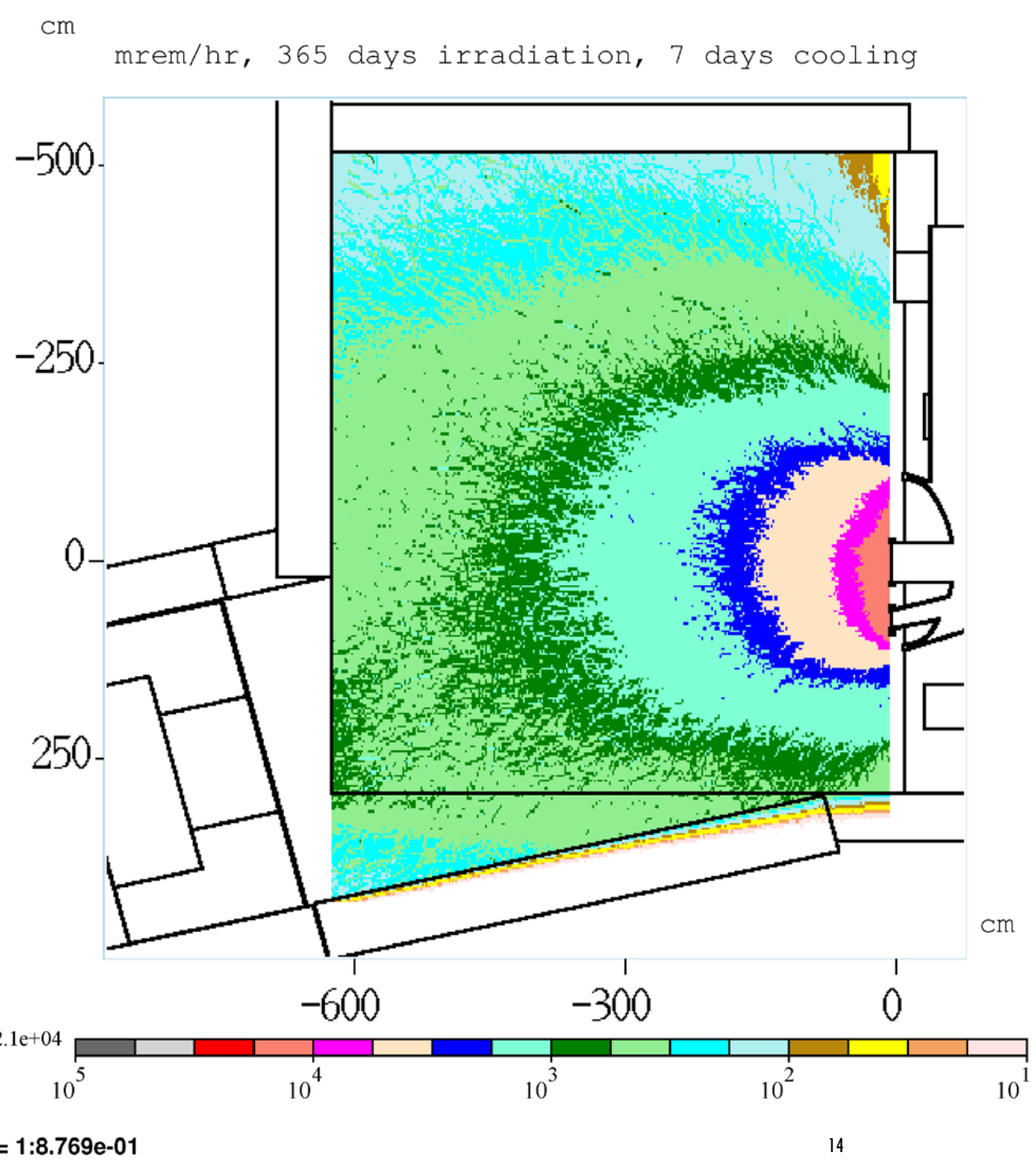
\vec{z}
 \vec{y} $y:z = 1:5.931e-01$



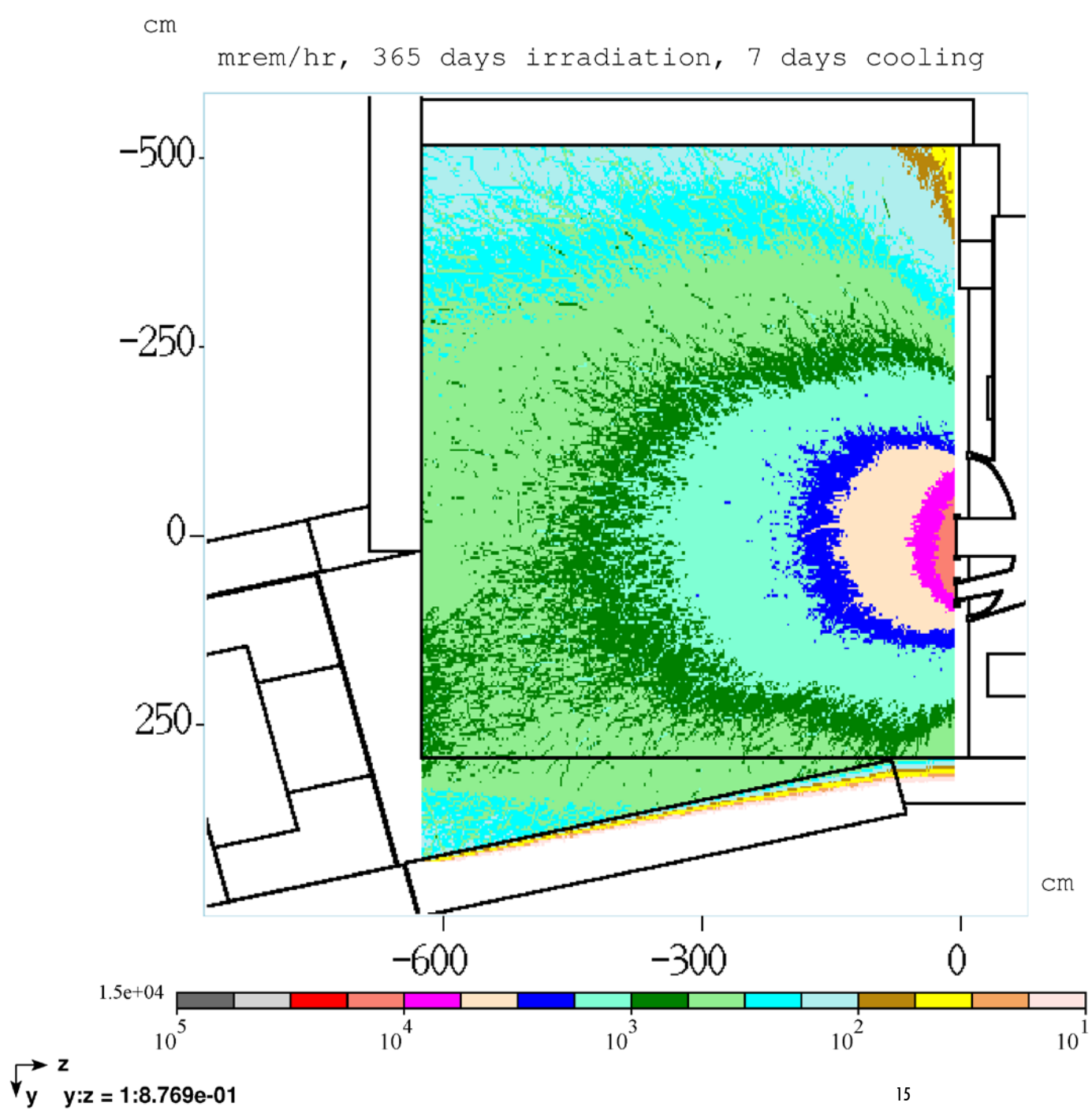
MARS SIMULATION STAGE 2 RESULTS

8 kW, 8 GeV proton beam
365 days irradiation
7 days cooling time

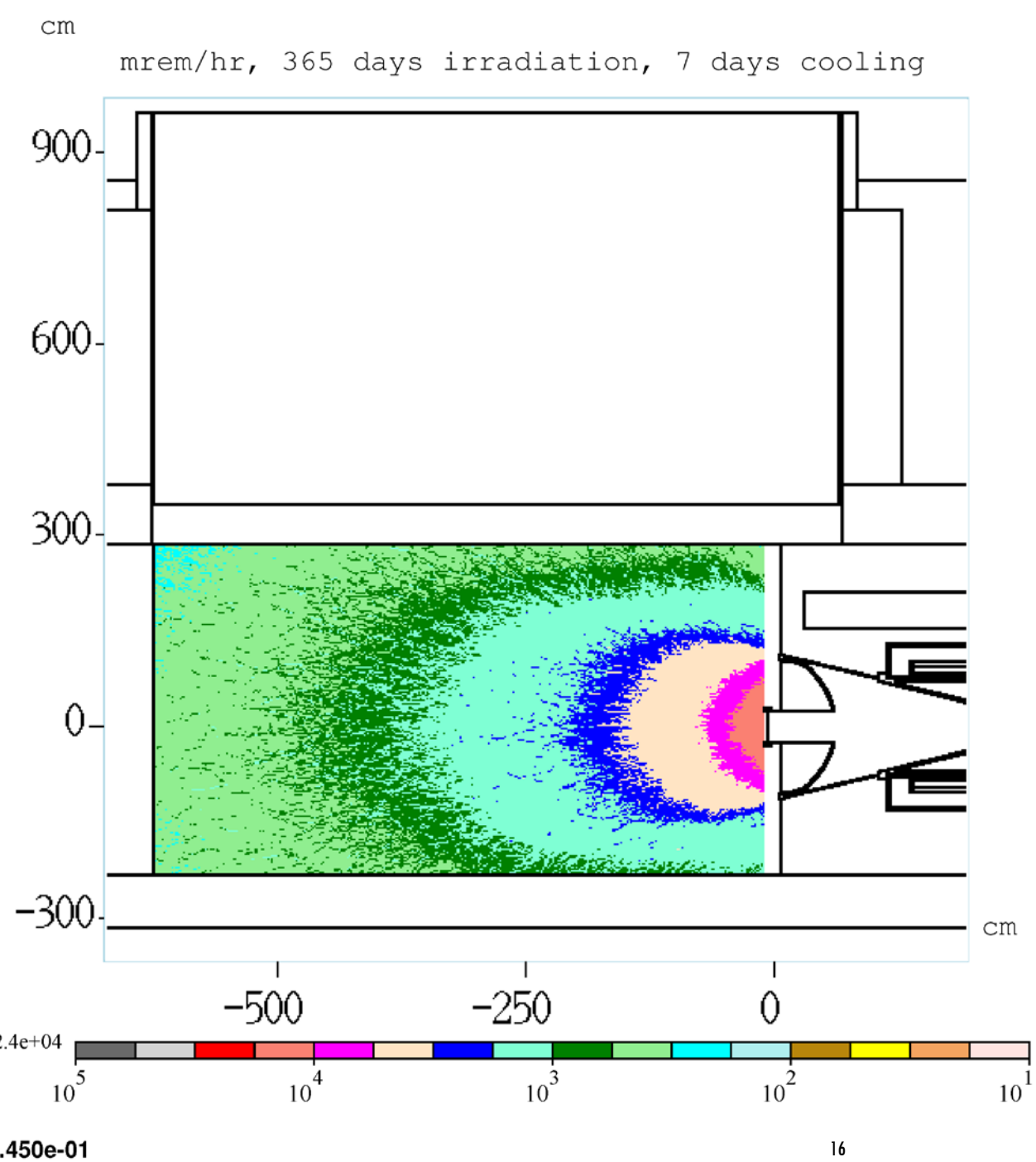
Plan view, mid plane of PS



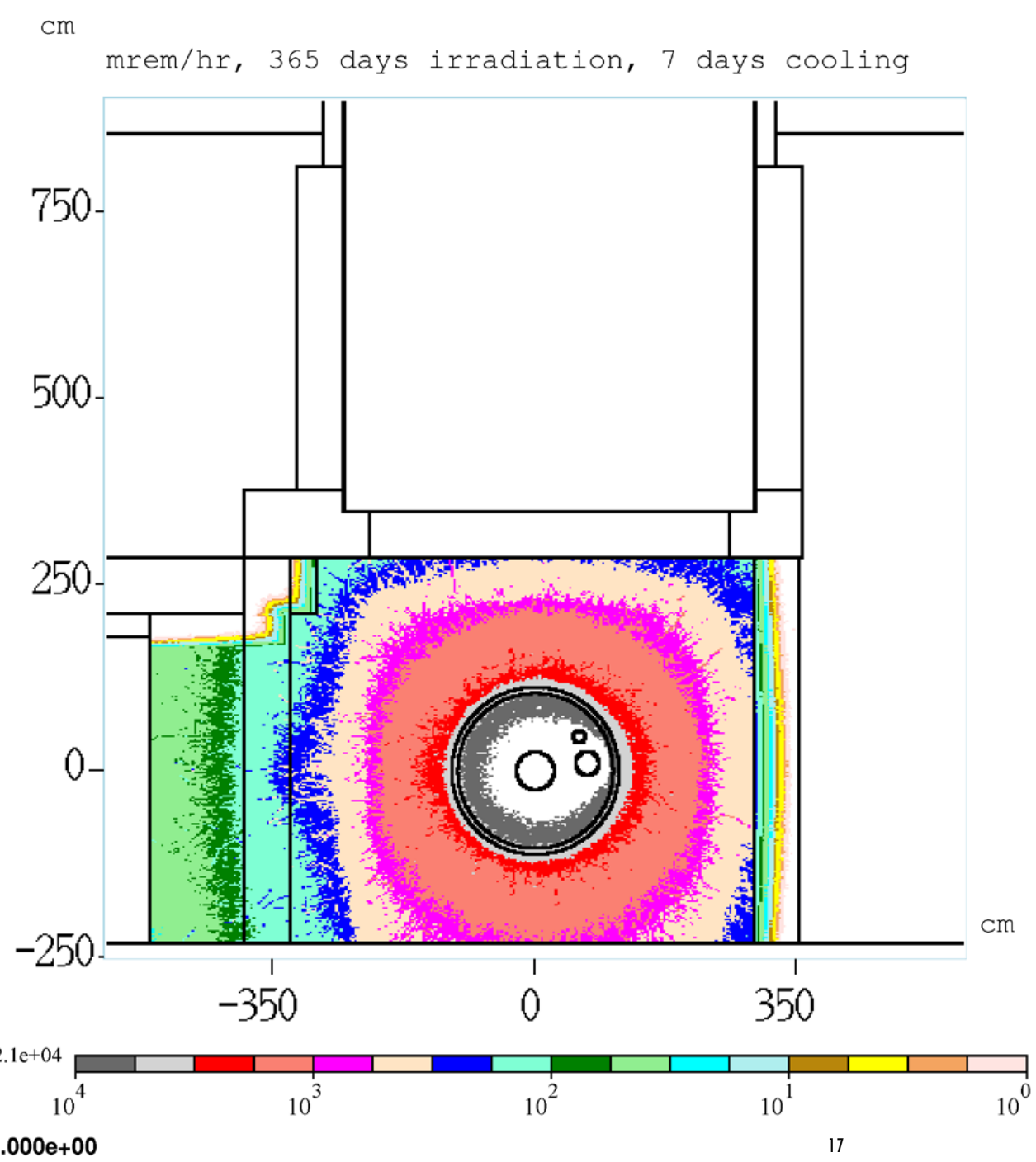
Plan view, mid plane of dump core



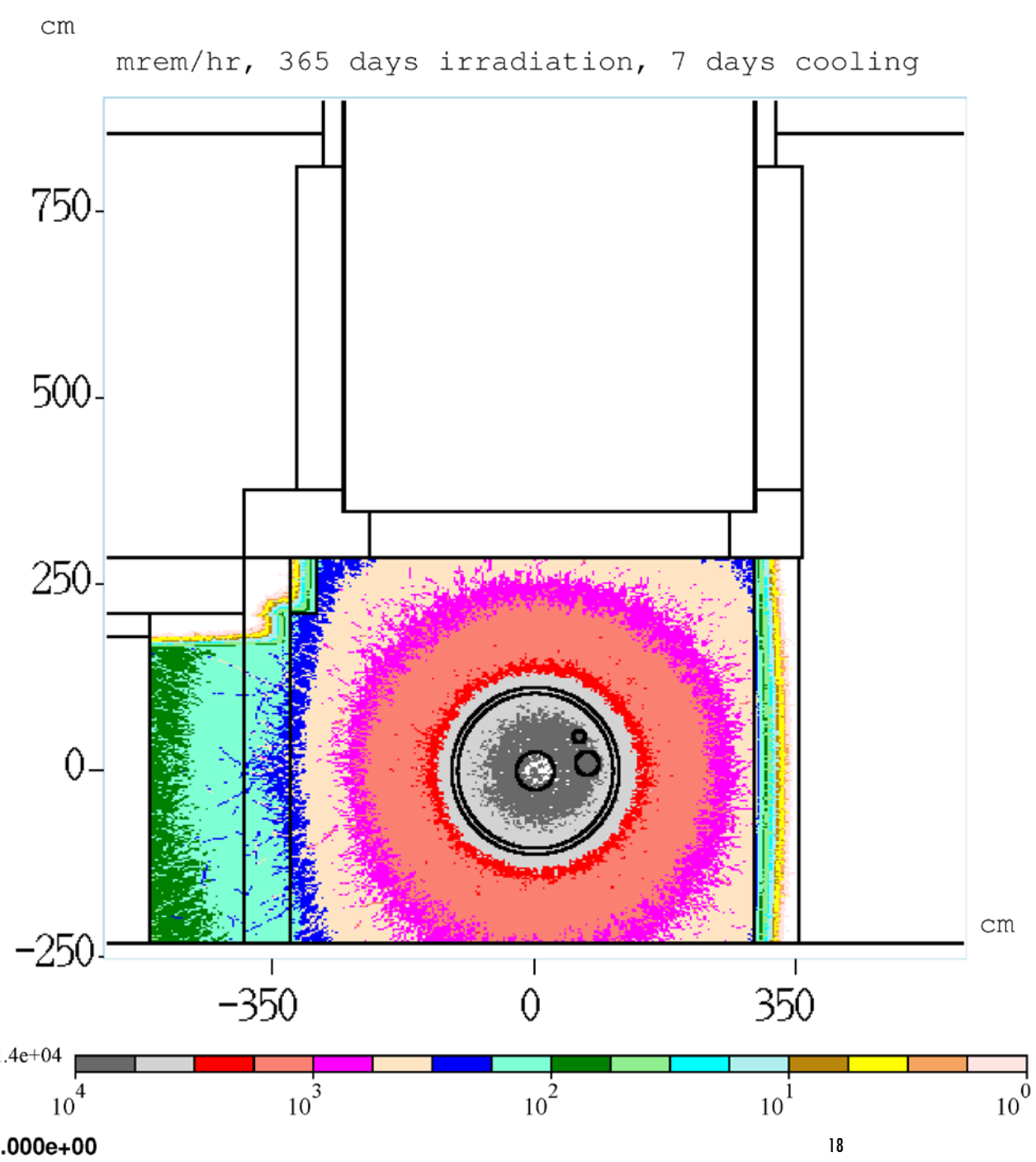
Elevation view, mid plane of PS



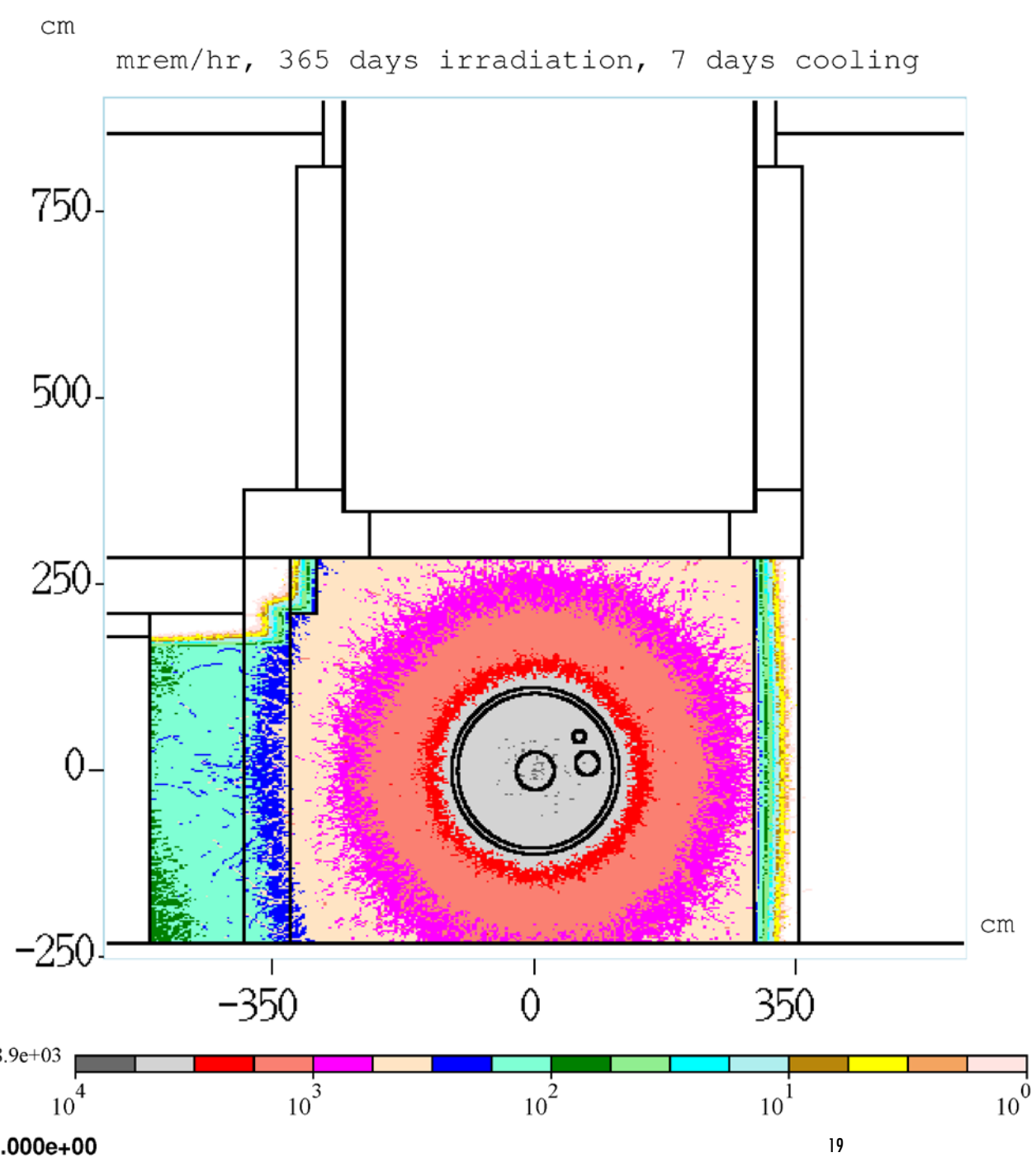
Cross section, 0 feet from extraction tube flange



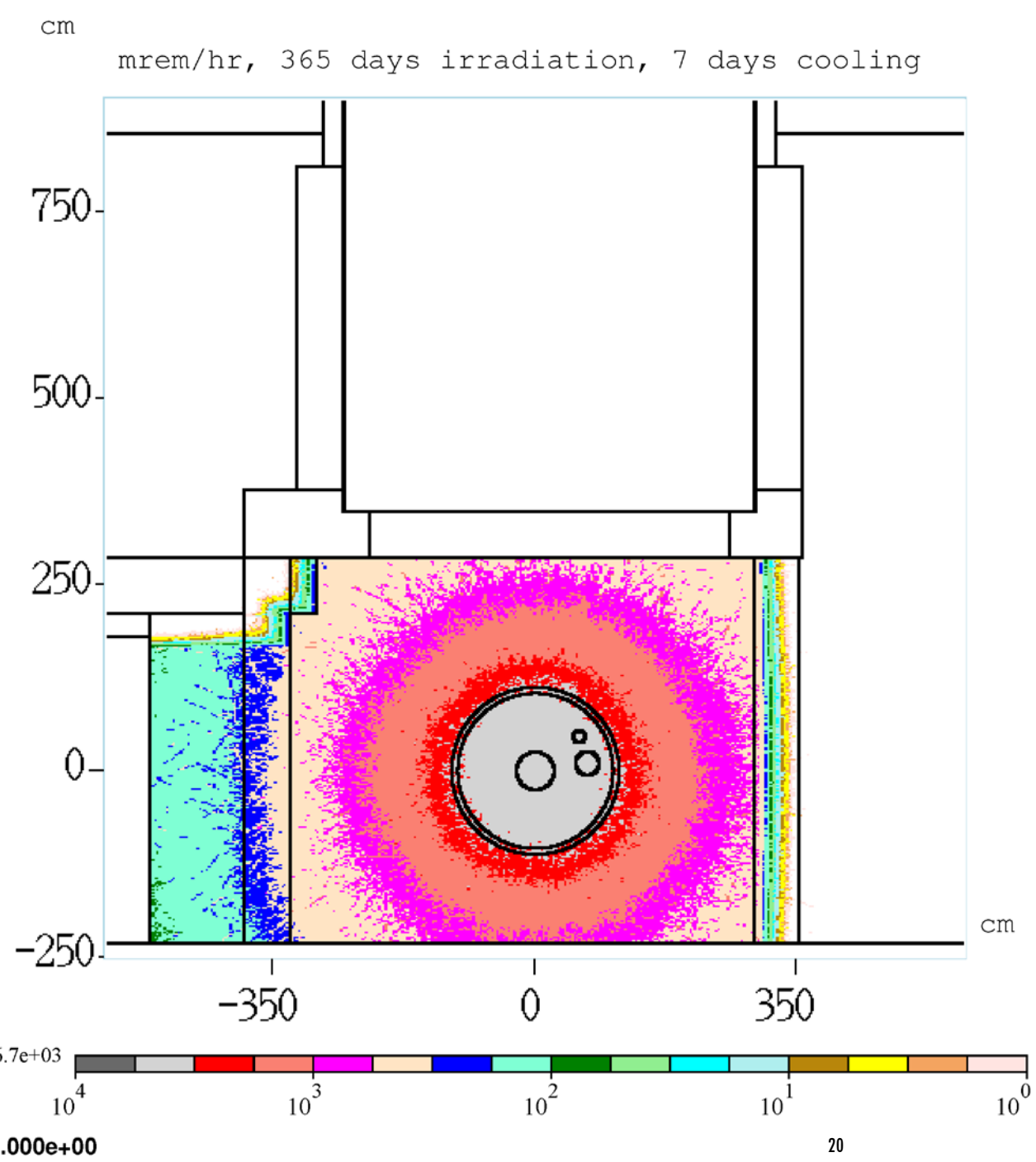
Cross section, 1 feet from extraction tube flange



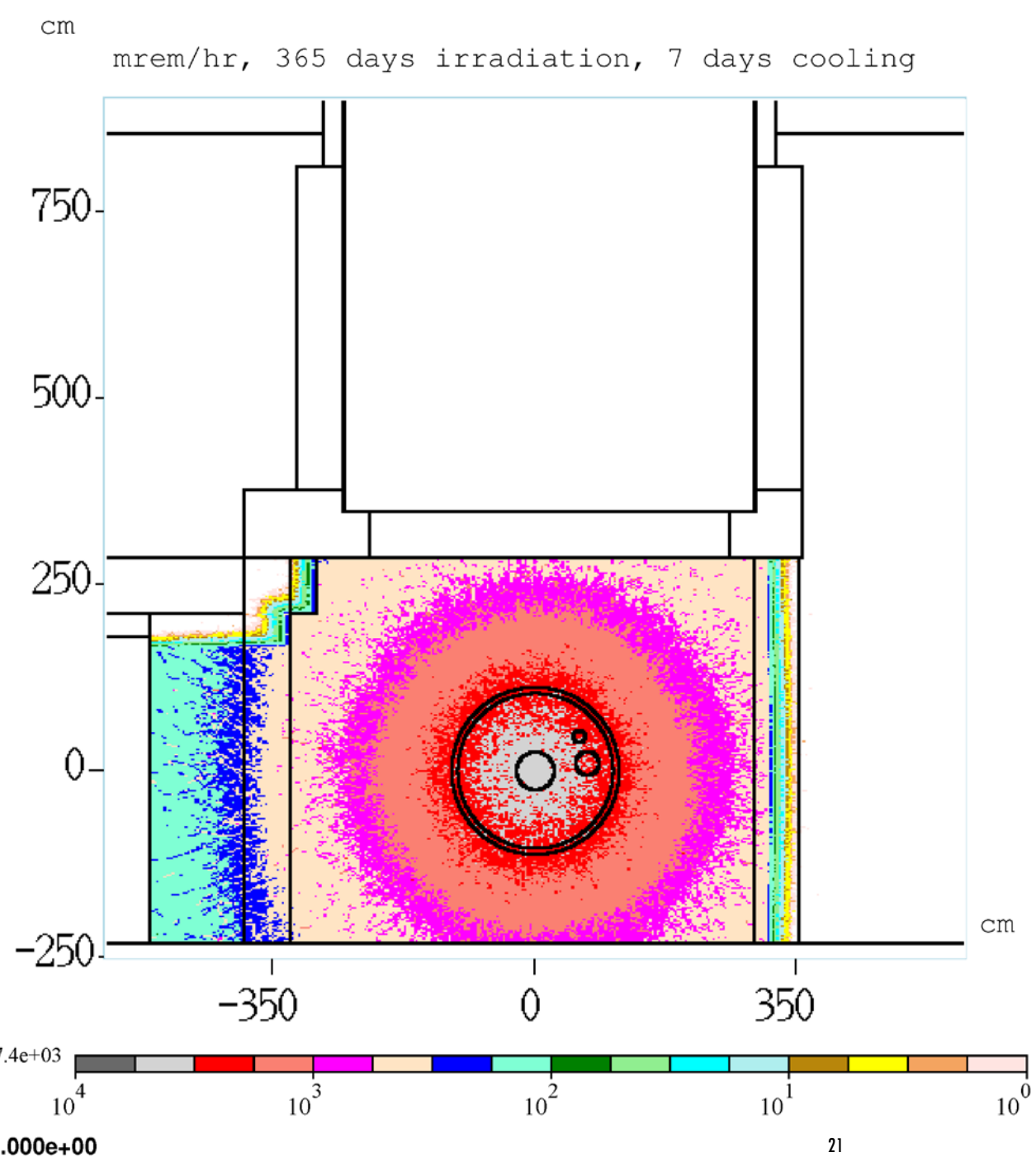
Cross section, 2 feet from extraction tube flange



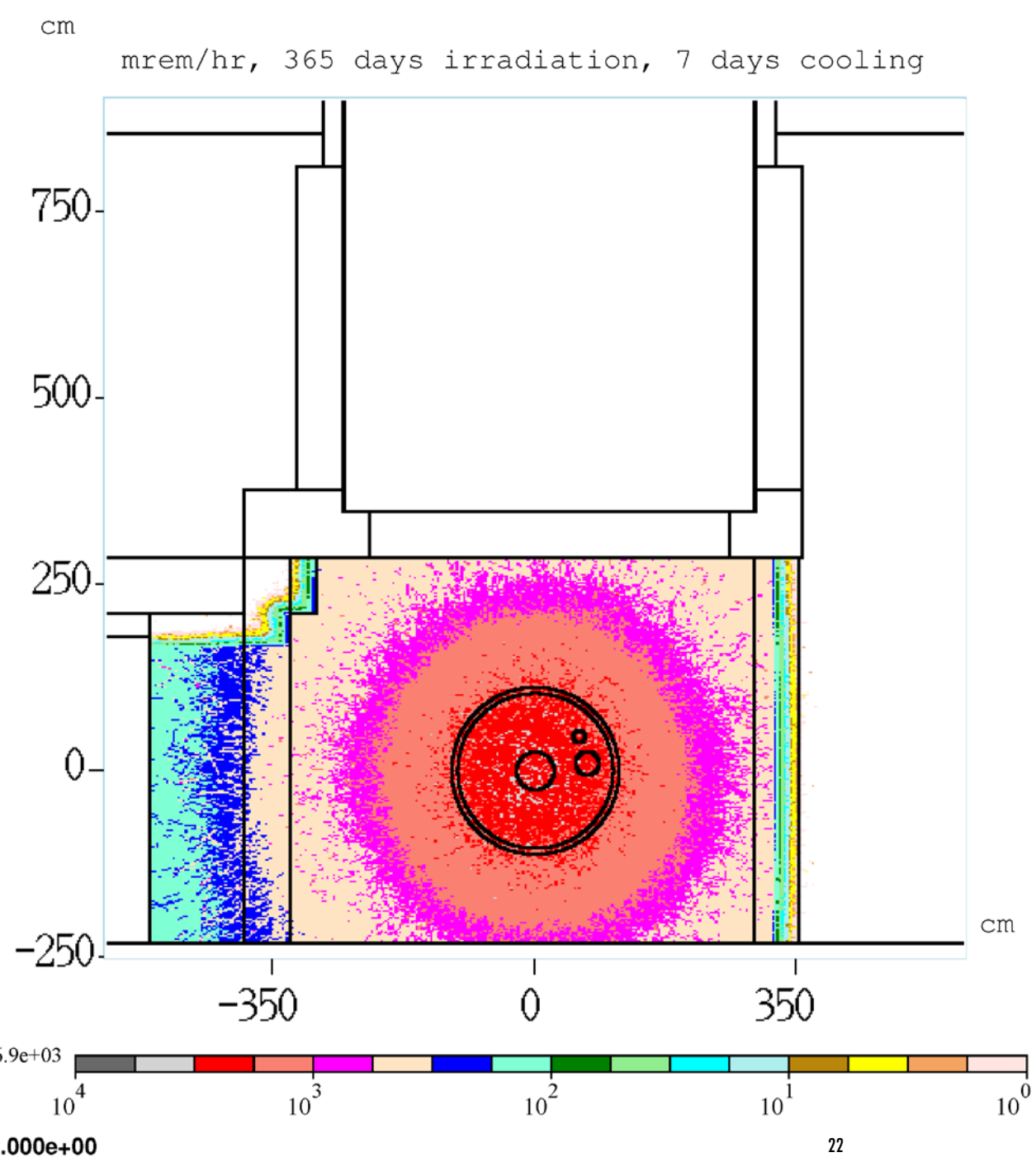
Cross section, 3 feet from extraction tube flange



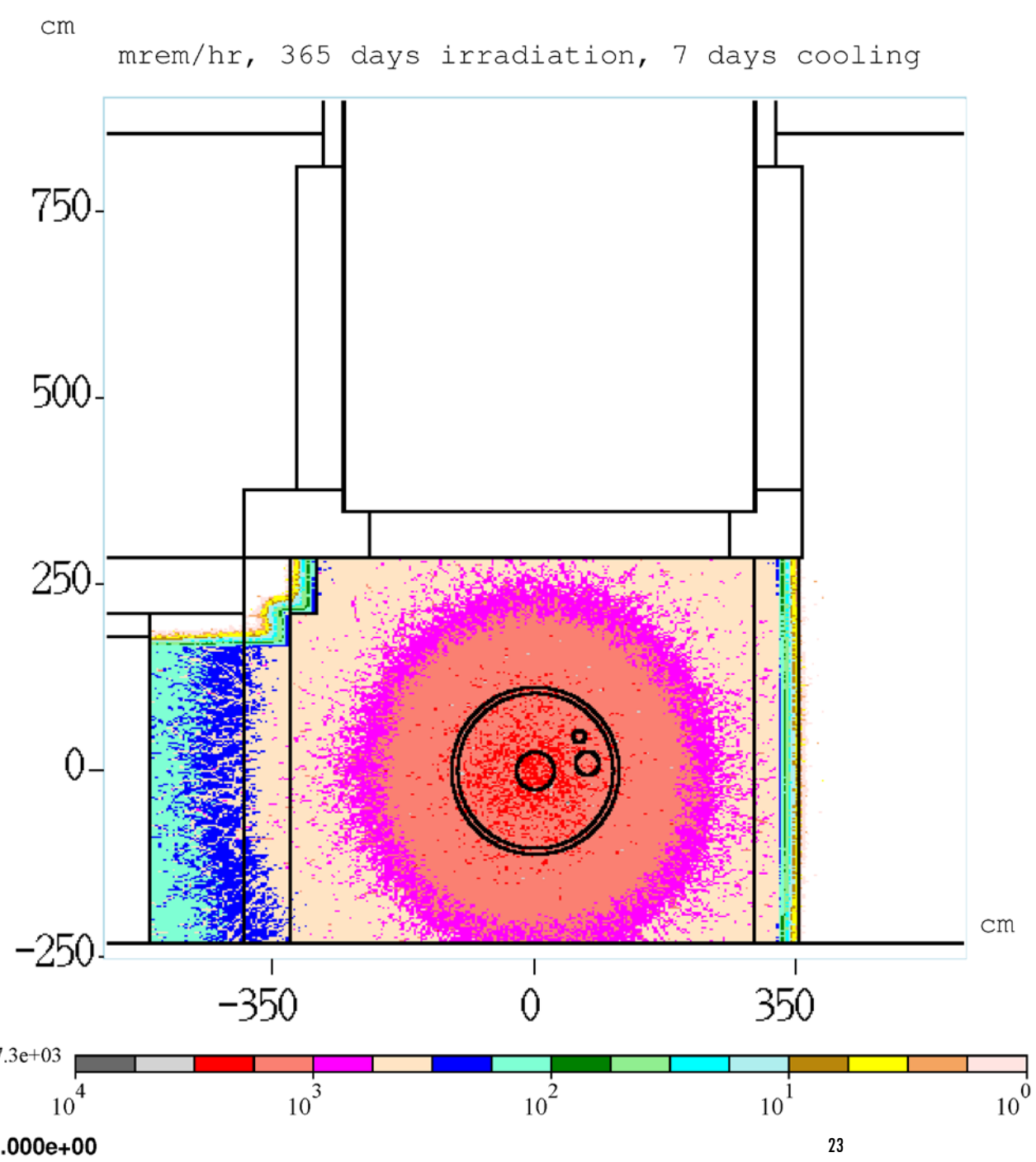
Cross section, 4 feet from extraction tube flange



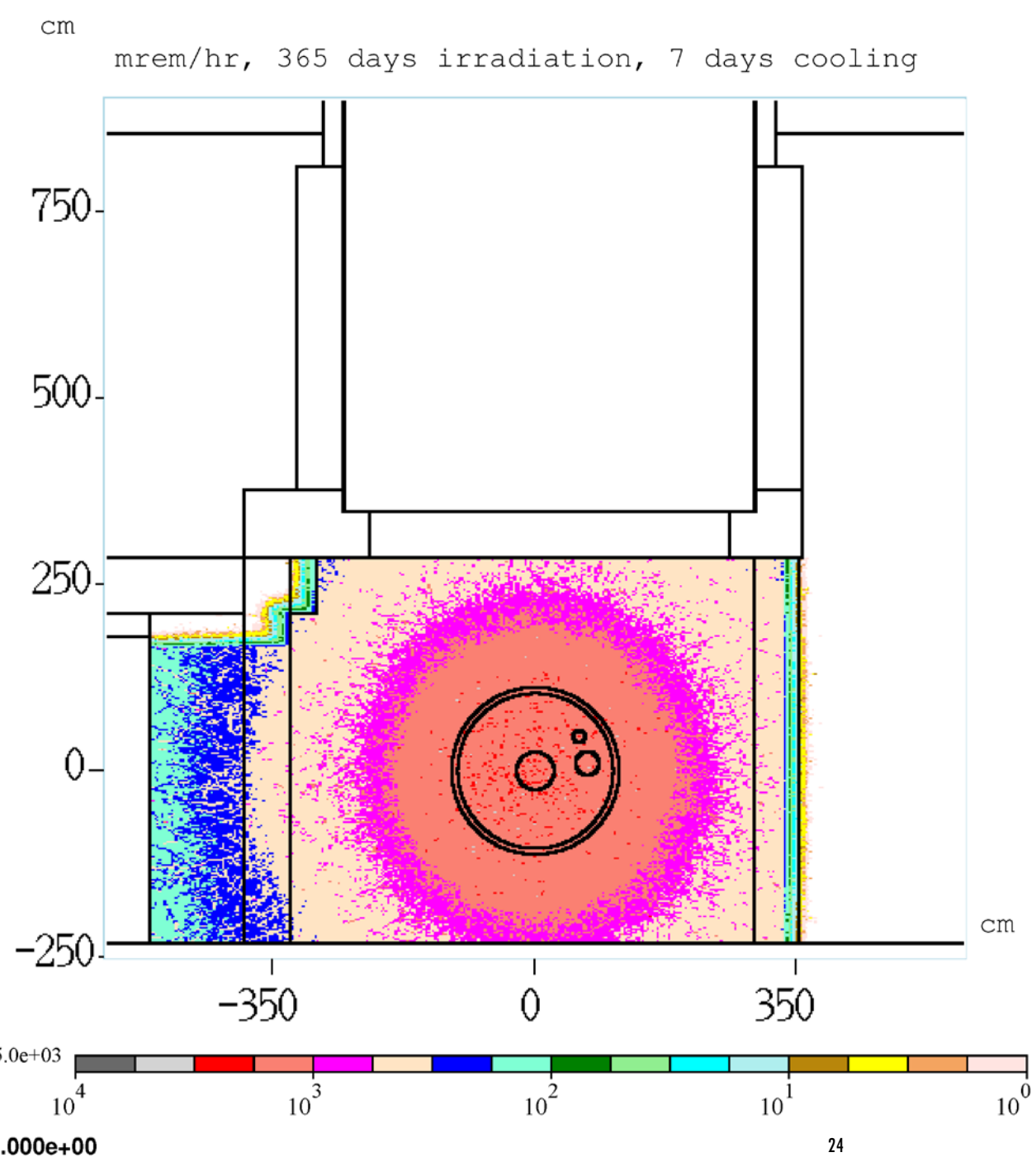
Cross section, 5 feet from extraction tube flange



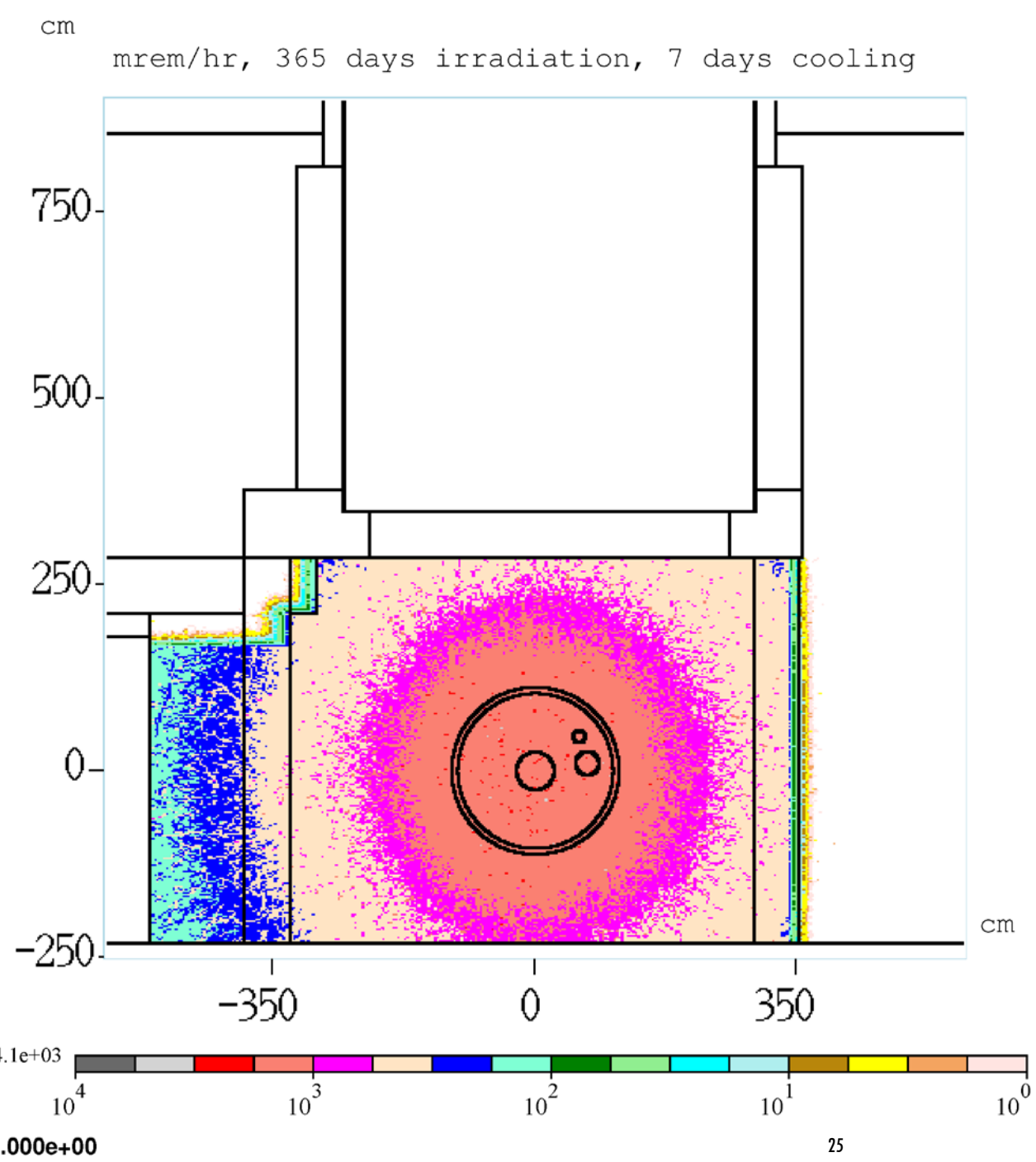
Cross section, 6 feet from extraction tube flange



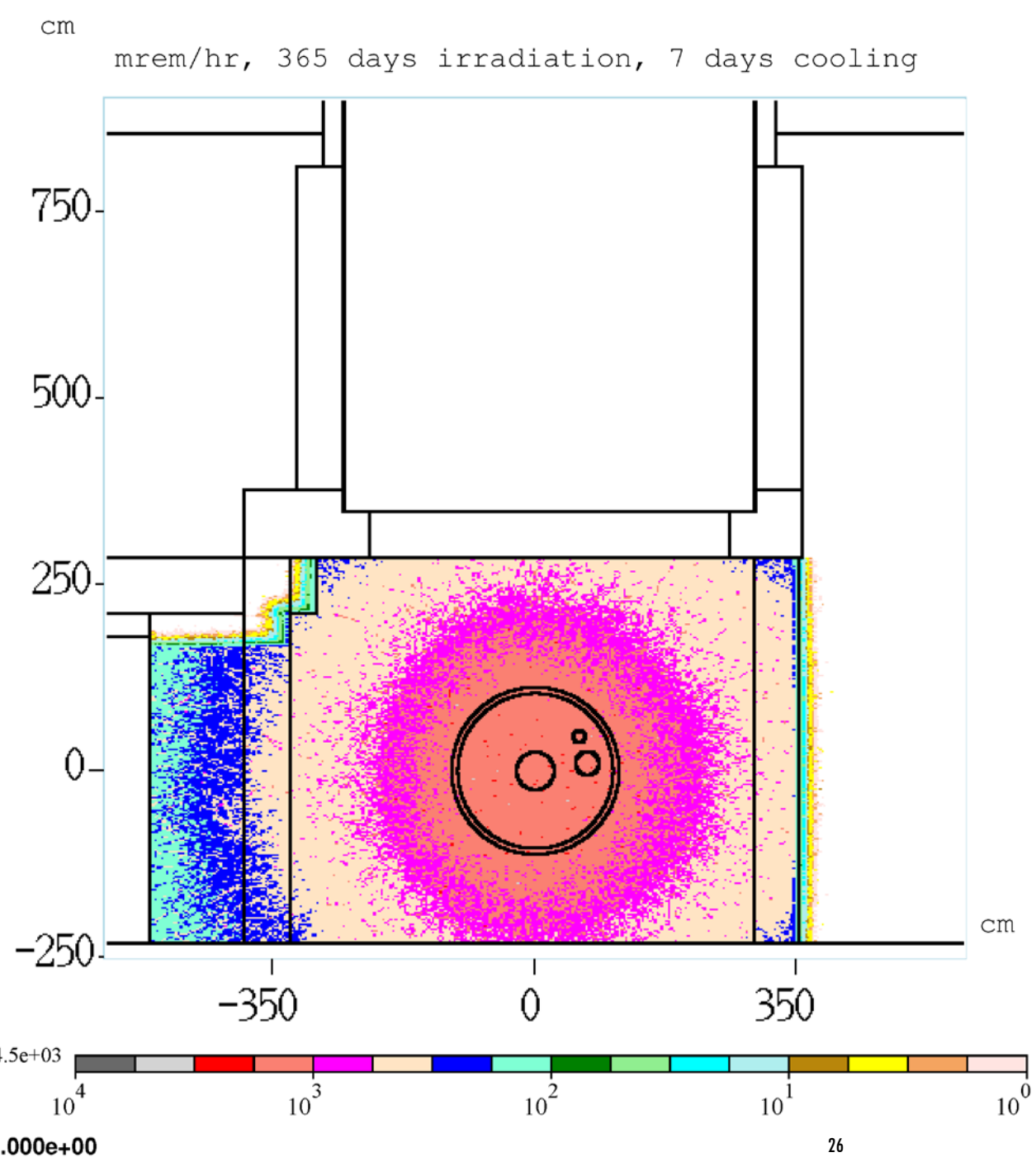
Cross section, 7 feet from extraction tube flange



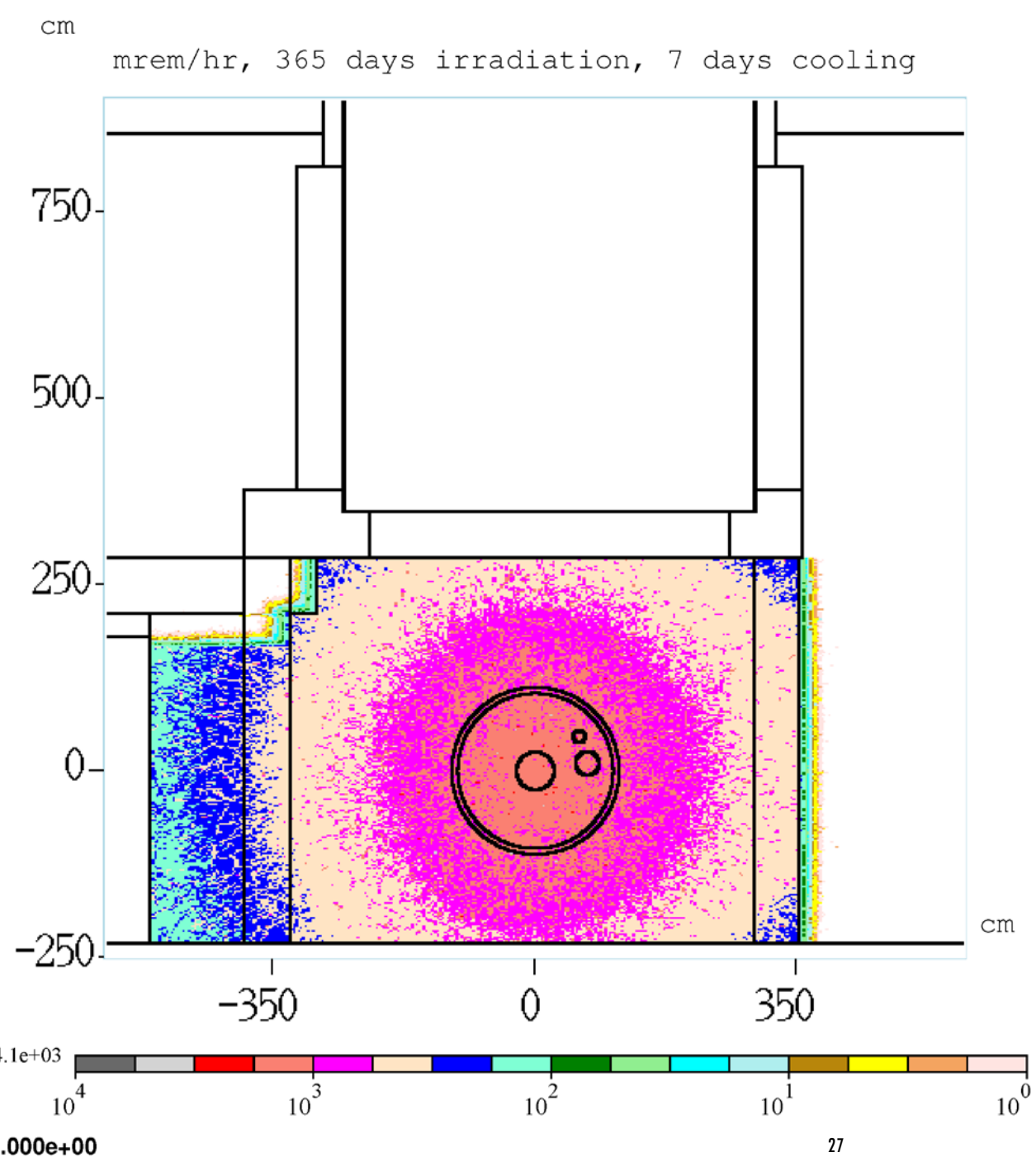
Cross section, 8 feet from extraction tube flange



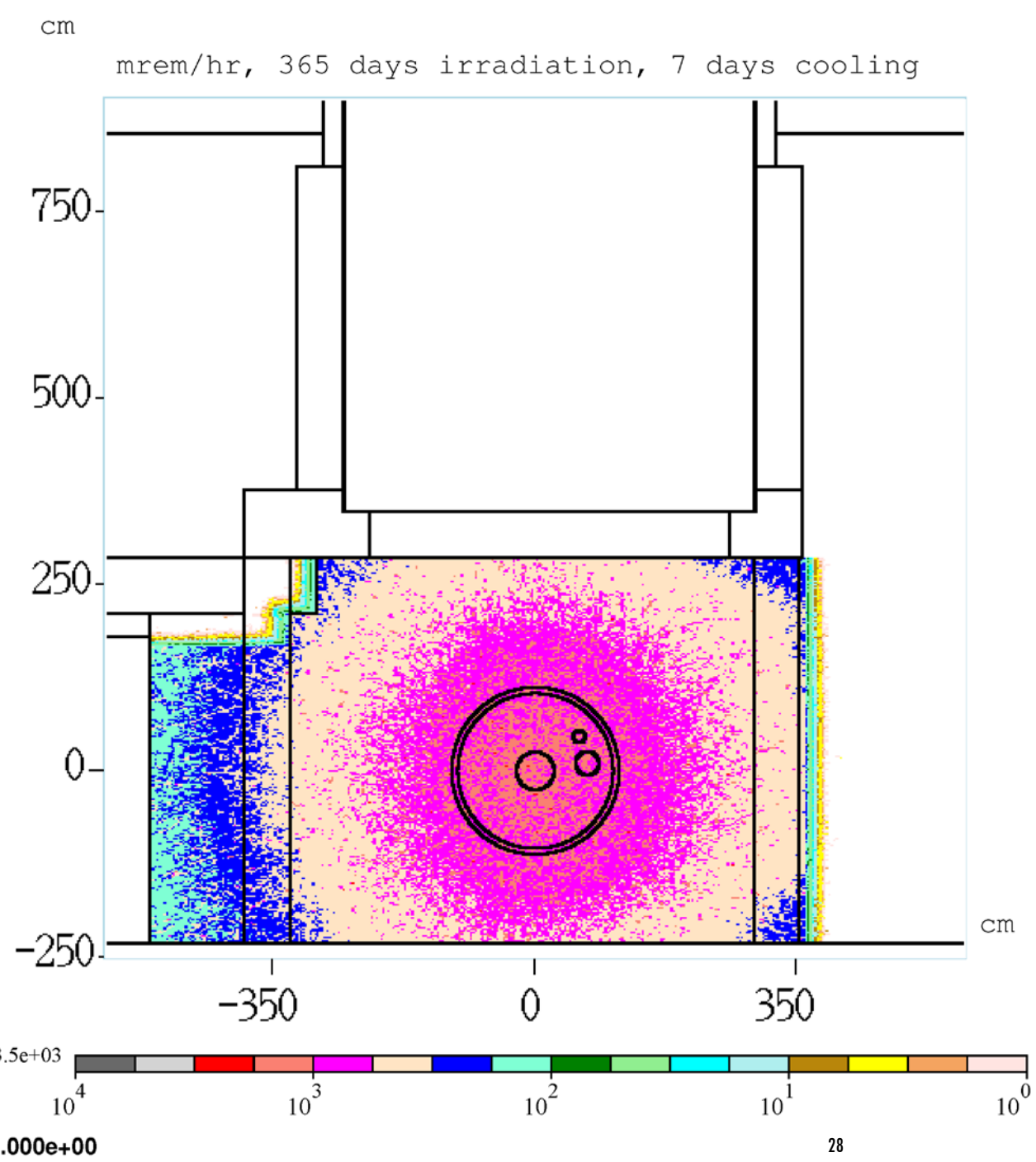
Cross section, 9 feet from extraction tube flange



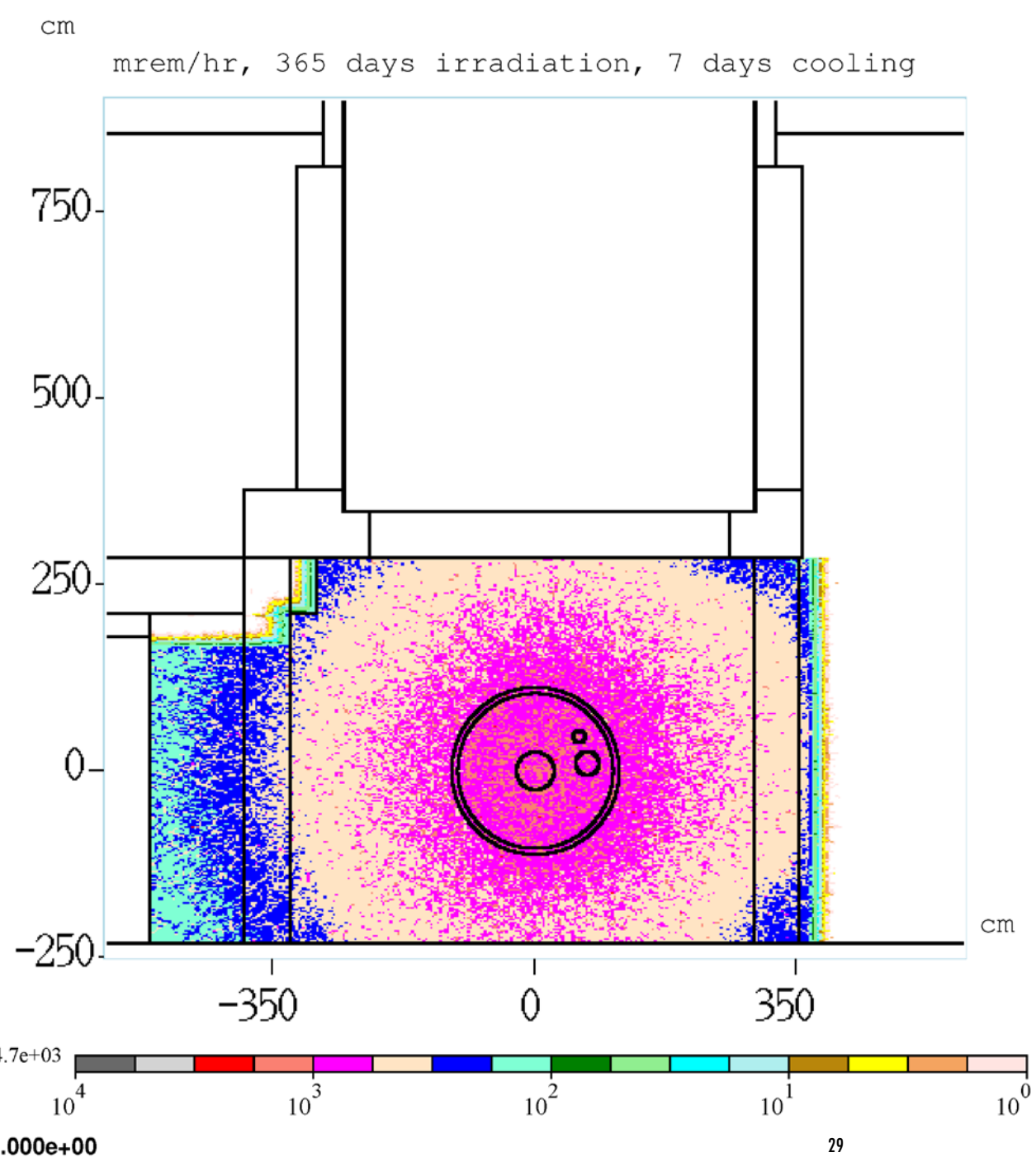
Cross section, 10 feet from extraction tube flange



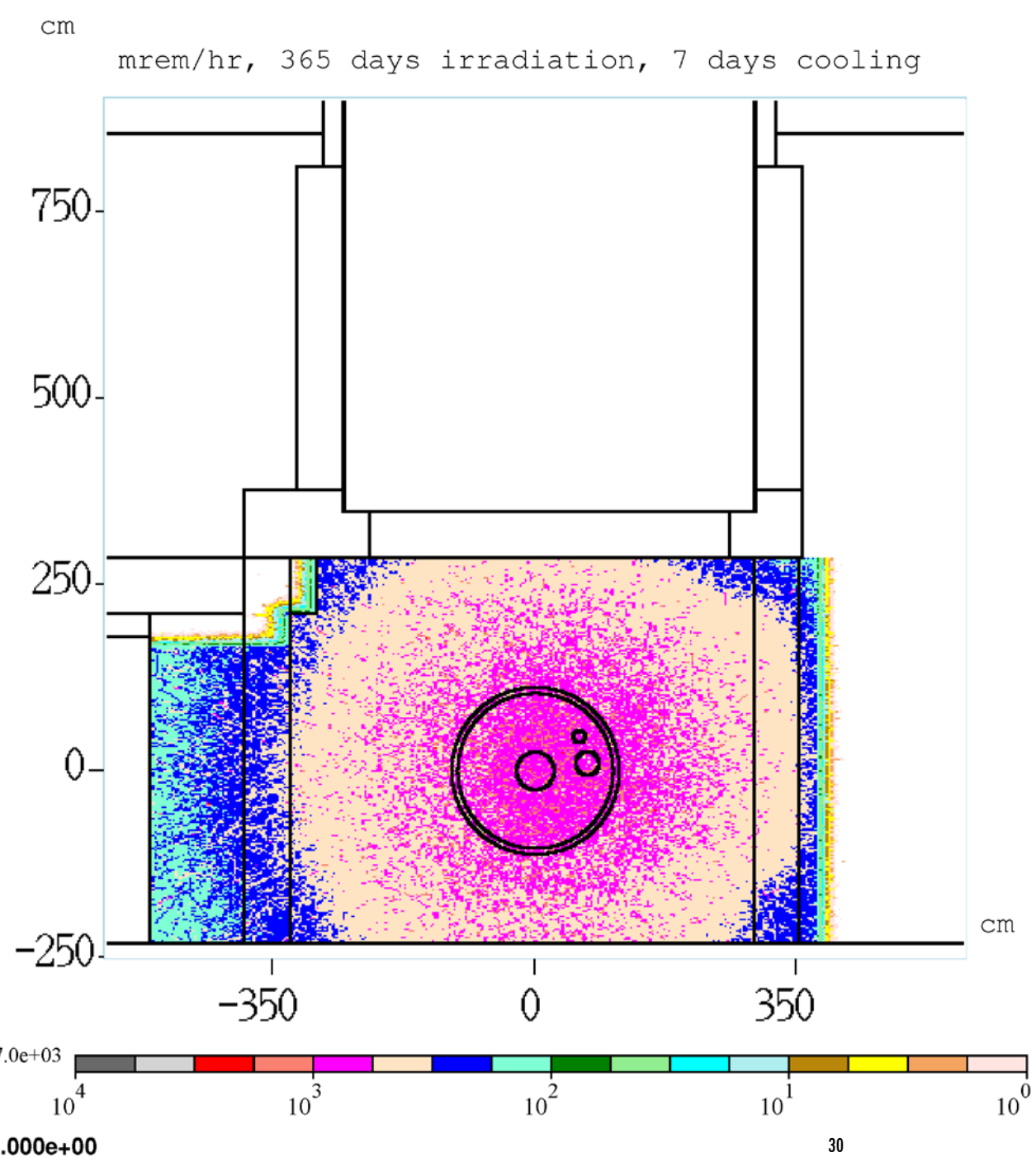
Cross section, 11 feet from extraction tube flange



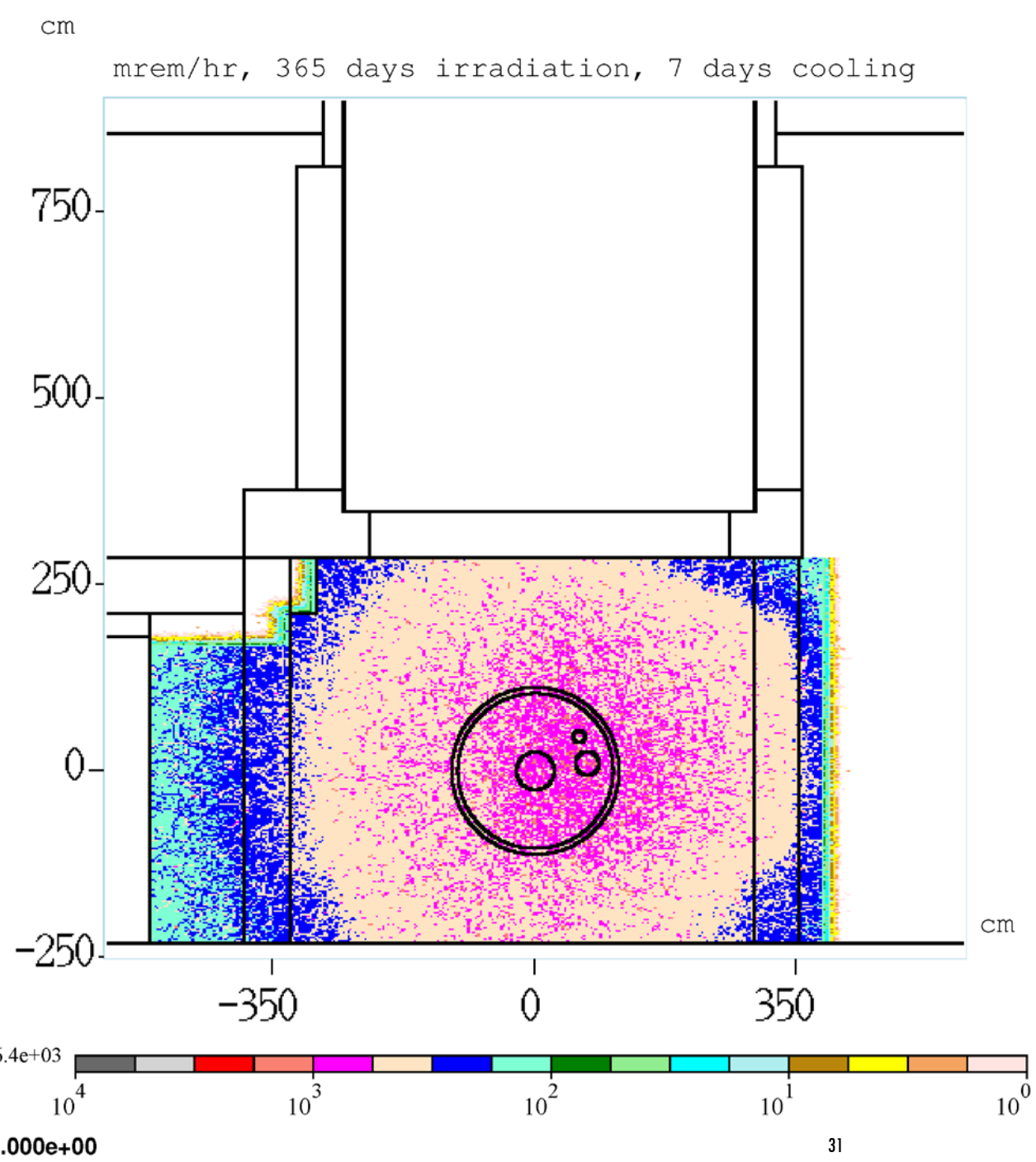
Cross section, 12 feet from extraction tube flange



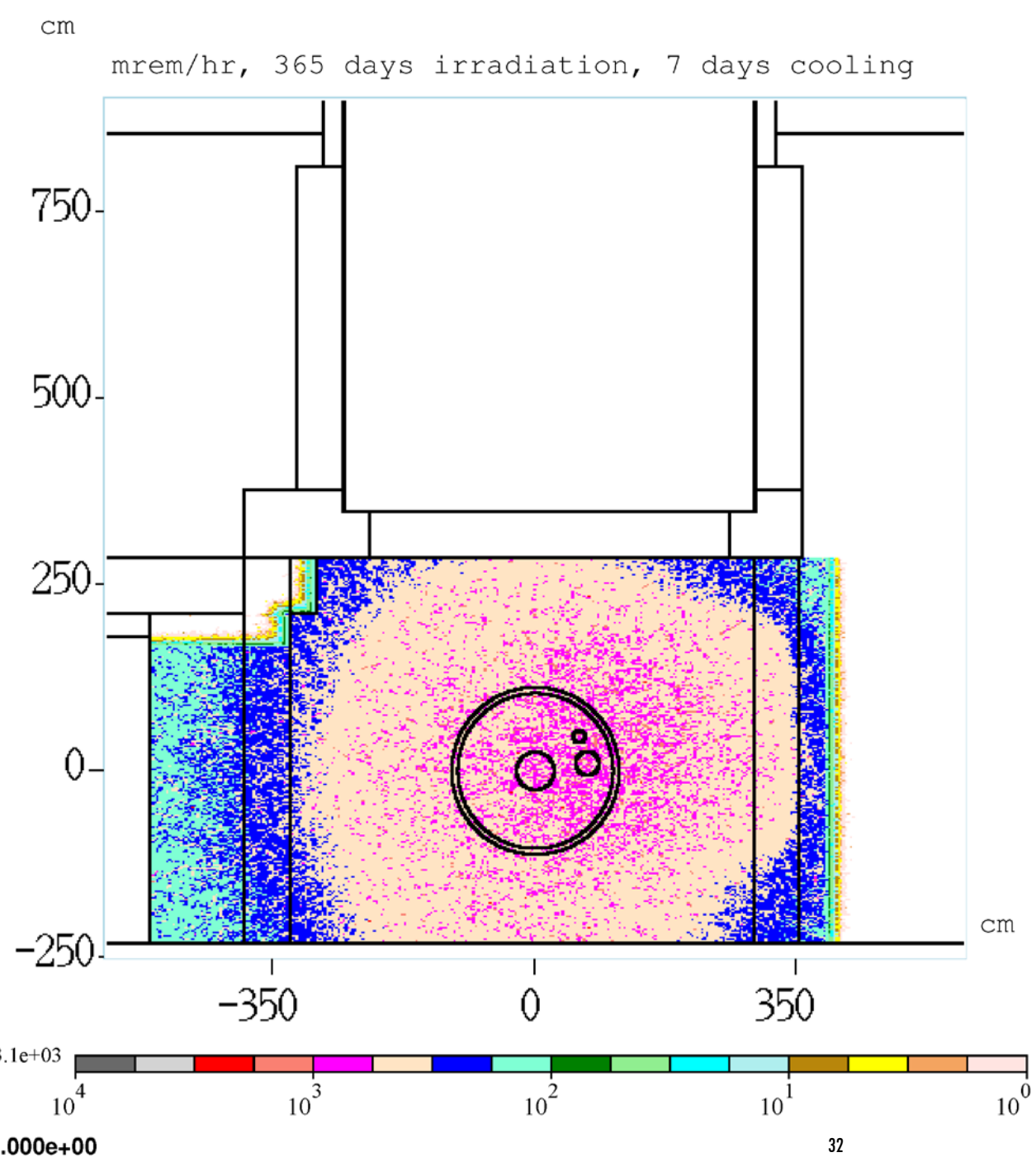
Cross section, 13 feet from extraction tube flange



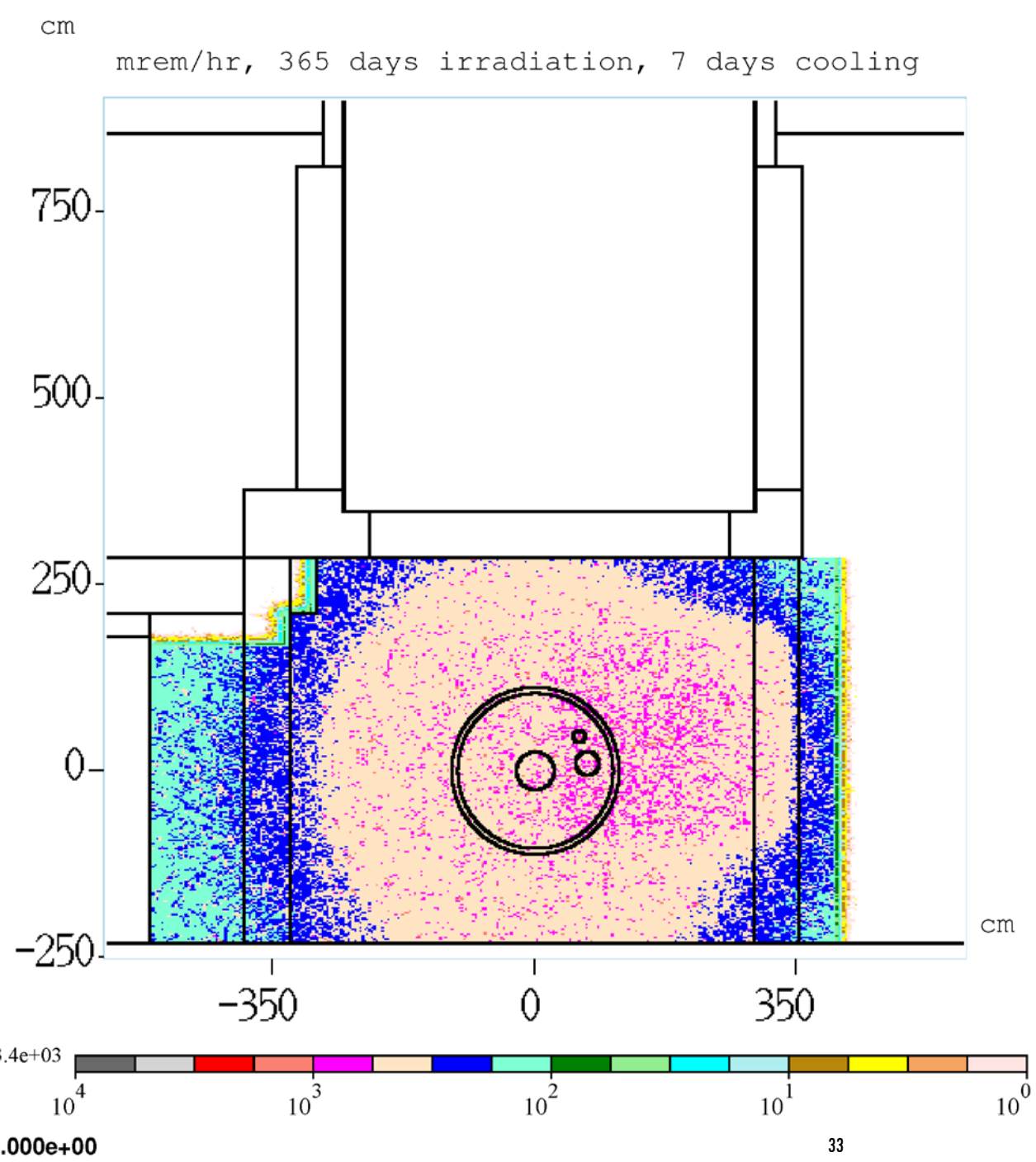
Cross section, 14 feet from extraction tube flange



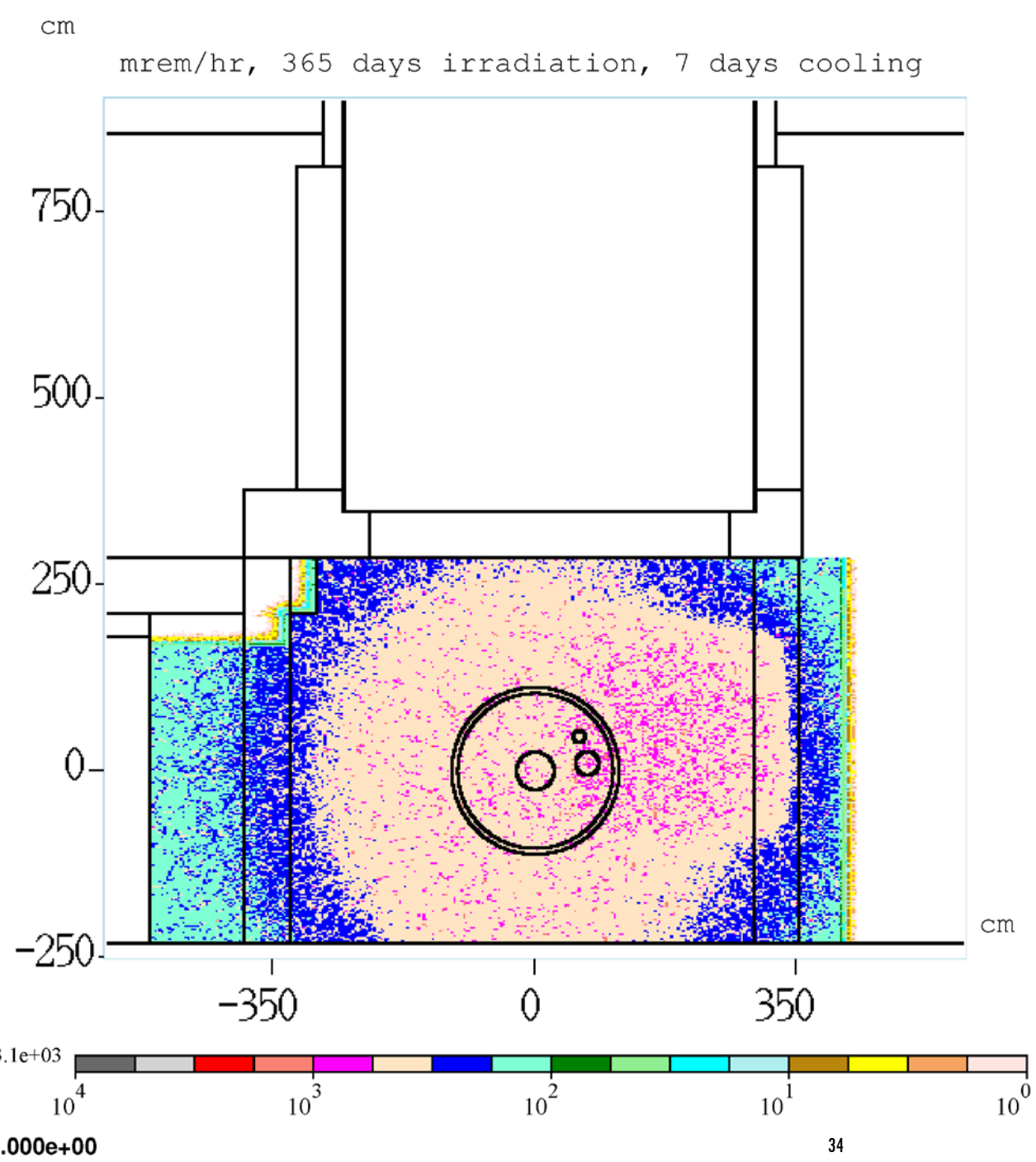
Cross section, 15 feet from extraction tube flange



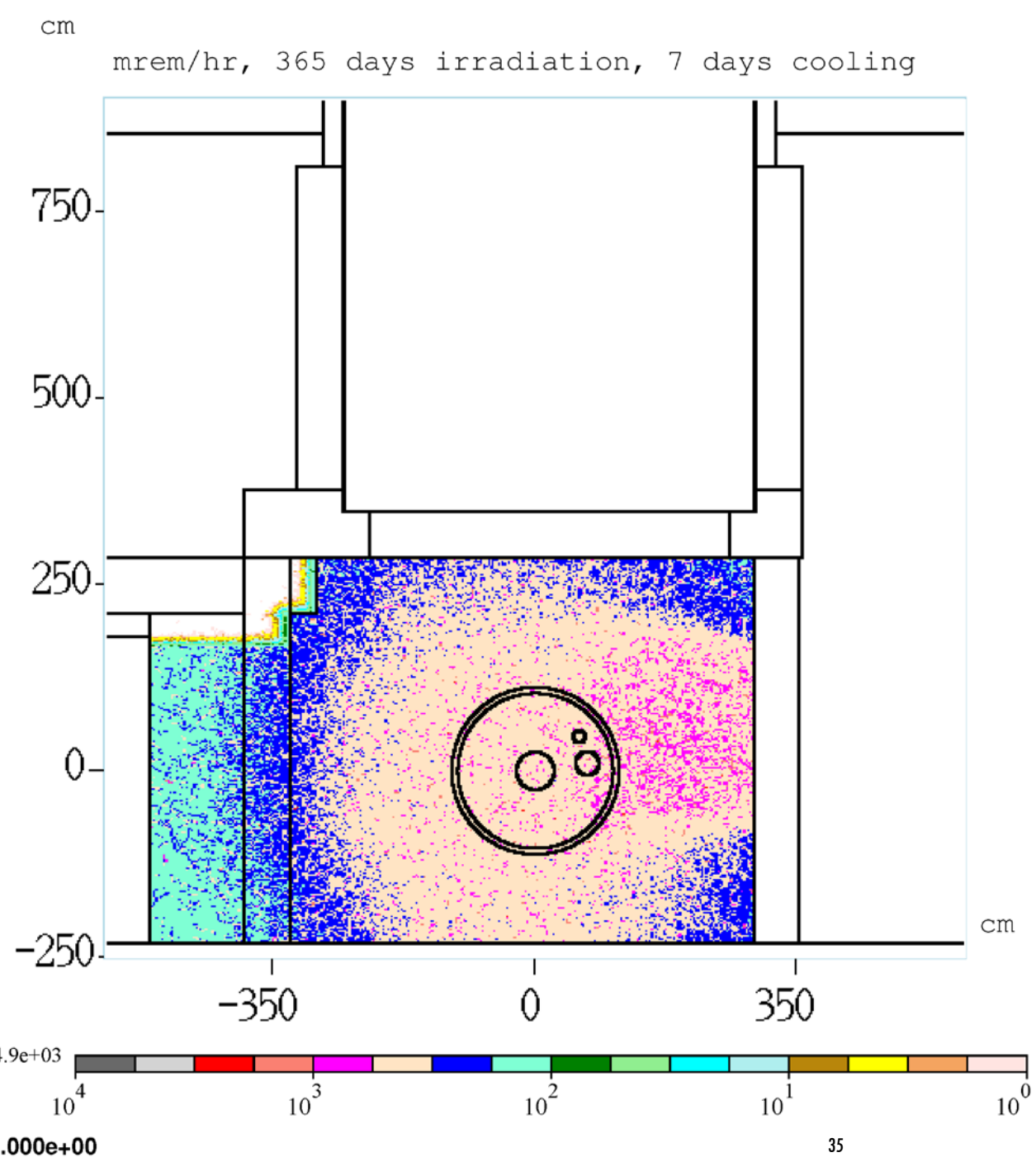
Cross section, 16 feet from extraction tube flange



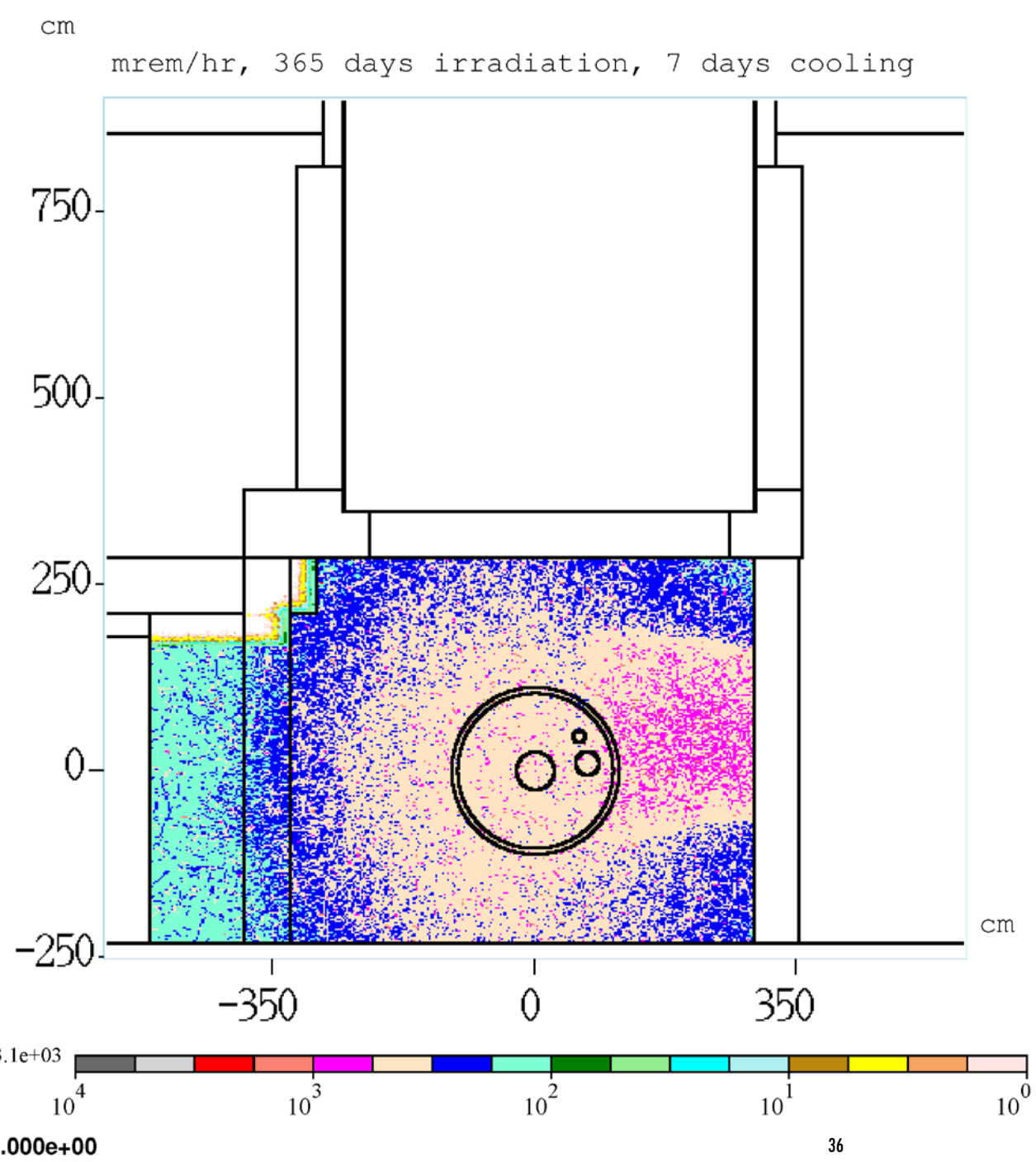
Cross section, 17 feet from extraction tube flange



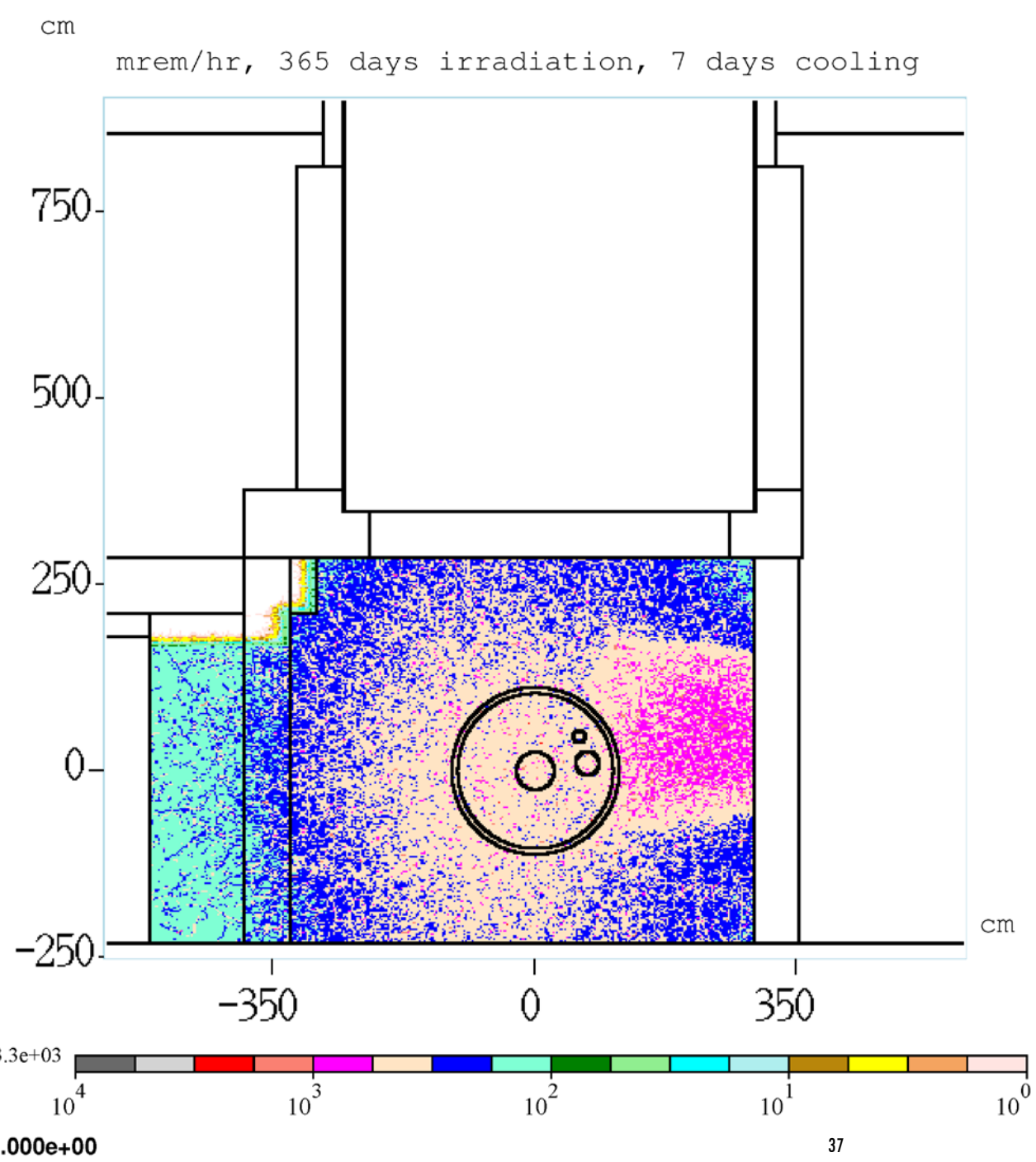
Cross section, 18 feet from extraction tube flange



Cross section, 19 feet from extraction tube flange



Cross section, 20 feet from extraction tube flange



CONCLUSIONS

The PS room is High Radiation Area

An end cap radiation shield was simulated in mu2e doc 5553-v1

It would be of interest to add such a shield and a second one for the dump to this model to determine the value in the use of temporary shields in the event extended personnel occupancy in the PS room is warranted.

If this is done, perhaps the source term from the west wall should first be calculated and added to the photon sources file to provide a more realistic picture. From mu2e doc 5572 v-4, the contact dose rate on the west wall is 470 mrem/hr after 7 days cooling time.