Fermilab

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Residual Dose of PIP-II Portable 2-kW Absorber

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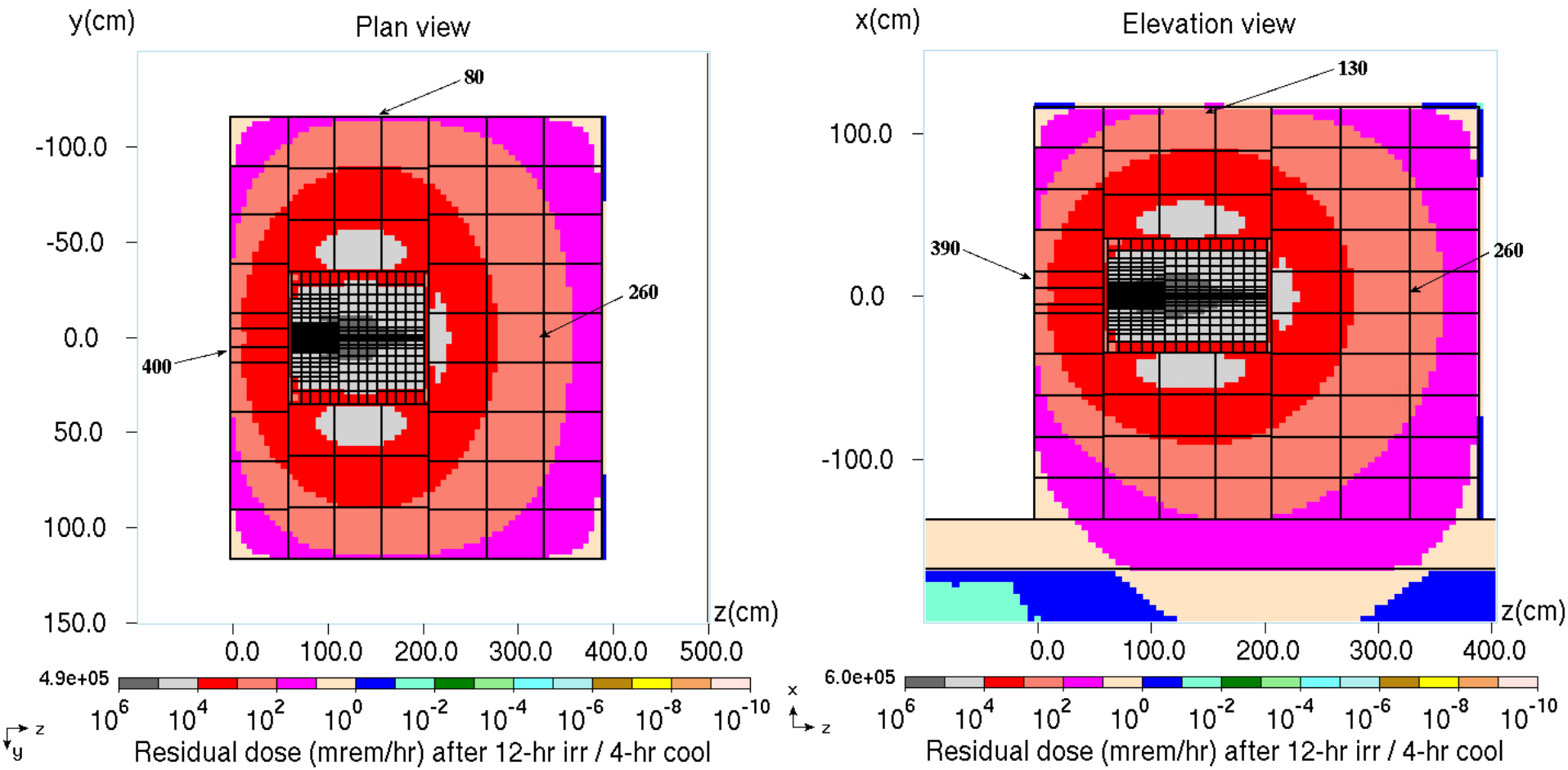
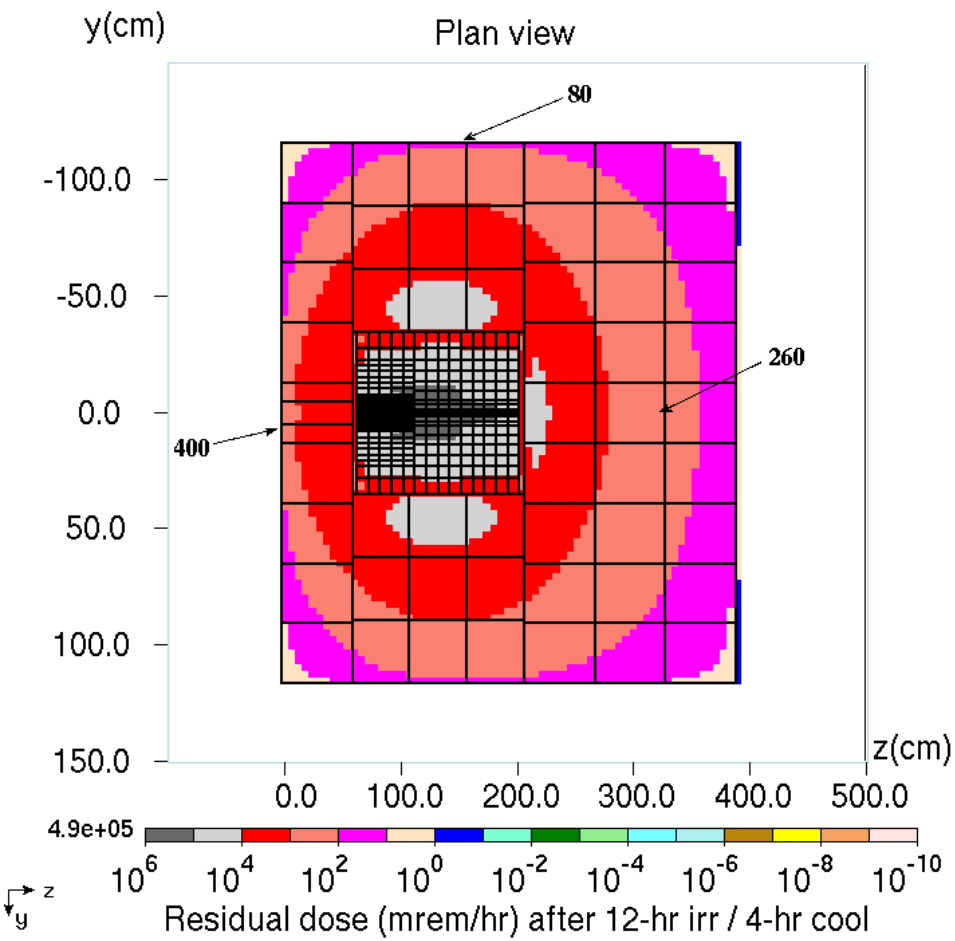
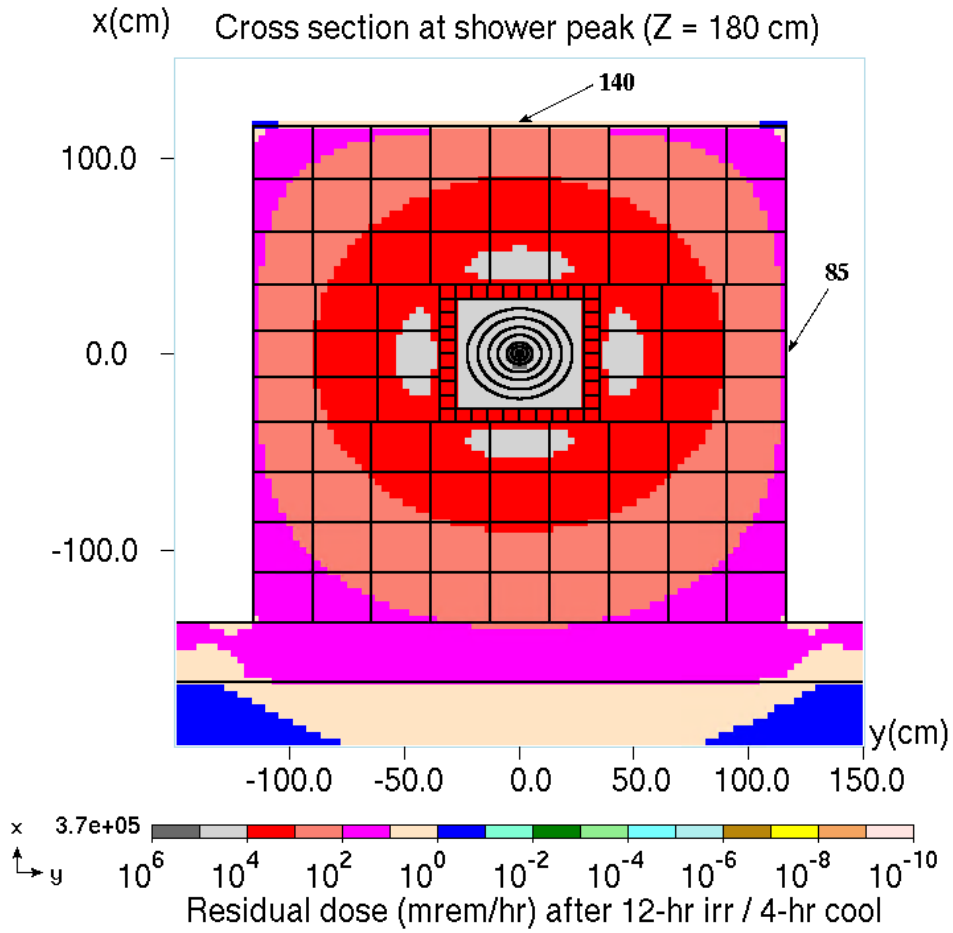
September 30, 2020


y(cm)
Plan view
80
260
400
-100.0
-50.0
0.0
50.0
100.0
150.0
z(cm)
0.0
100.0
200.0
300.0
400.0
500.0
4.9e+05
10^{6} 10^{4} 10^{2} 10^{0} 10^{-2} 10^{-4} 10^{-6} 10^{-8} 10^{-10}
Residual dose (mrem/hr) after 12-hr irr / 4-hr cool
x(cm)
Elevation view
130
390
260
100.0
0.0
-100.0
z(cm)
0.0
100.0
200.0
300.0
400.0
6.0e+05
10^{6} 10^{4} 10^{2} 10^{0} 10^{-2} 10^{-4} 10^{-6} 10^{-8} 10^{-10}
Residual dose (mrem/hr) after 12-hr irr / 4-hr cool


y(cm)
Plan view
80
260
400
-100.0
-50.0
0.0
50.0
100.0
150.0
z(cm)
0.0
100.0
200.0
300.0
400.0
500.0
4.9e+05
10^{6} 10^{4} 10^{2} 10^{0} 10^{-2} 10^{-4} 10^{-6} 10^{-8} 10^{-10}
z
y
Residual dose (mrem/hr) after 12-hr irr / 4-hr cool


x(cm)
Cross section at shower peak (Z = 180 cm)
140
85
100.0
0.0
-100.0
y(cm)
-100.0
-50.0
0.0
50.0
100.0
150.0
3.7e+05
10^{6} 10^{4} 10^{2} 10^{0} 10^{-2} 10^{-4} 10^{-6} 10^{-8} 10^{-10}
x
y
Residual dose (mrem/hr) after 12-hr irr / 4-hr cool

Conclusions

- The concrete thickness around the absorber core is (approximately) the following:
  - 80 cm upward, downward, and to the left and right;
  - 180 cm downstream;
  - 60 cm upstream.
- The spikes in residual dose close to the absorber core steel case are due to increased interaction rate in the steel case (steel density is ~3 time more than that of Al).
- Replacement of the steel case with Aluminum will flatten the dose spikes, but the **residual dose of the Aluminum case will be high anyway, a rough estimate is ~3,000 – 5,000 mrem/hr**. It might be makes sense to keep the steel case.
- One can remove 1 or 2 ft of concrete from the downstream end and add it to the front, that will reduce the dose upstream so that each side of the absorber will have approximately the same dose.
- This used scenario – 12-hr irradiation / 4-hr cooling – provides 2D dose distributions. There are no 2D distributions for the irradiation scenario 4-hr irradiation / 4-hr cooling. I can make some numerical estimates for the 4-hr irr / 4-hr cool scenario for our final design. The dose for this scenario is expected to be **lower by a factor from 2 to 3 compared to the 12-hr / 4-hr scenario**.
- **Let us make a decision if we need those concrete blocks around the absorber core (and how much). The blocks can be hand-stacked around the absorber core.**
- **After that I will make Energy Deposition calculations for a thermal analysis.**