MARS15 simulations for Booster Injection Absorber

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PDR Review

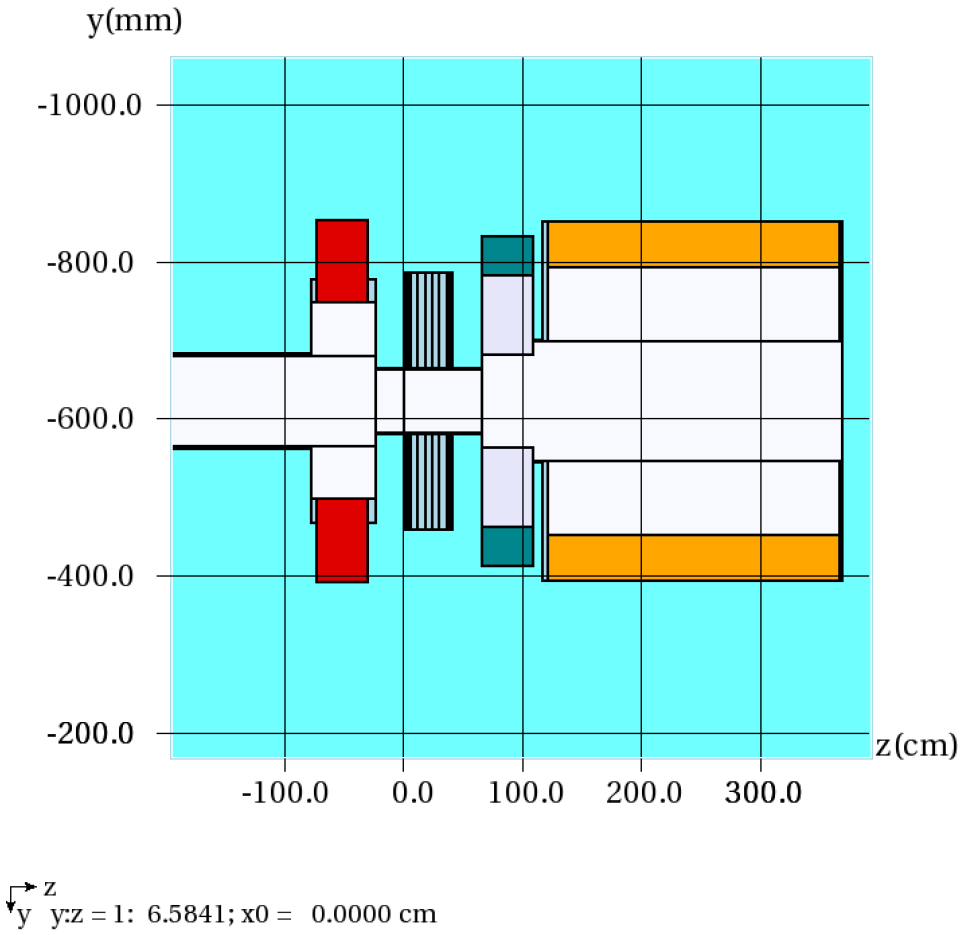
Booster Injection Absorber (BIA) dose studies

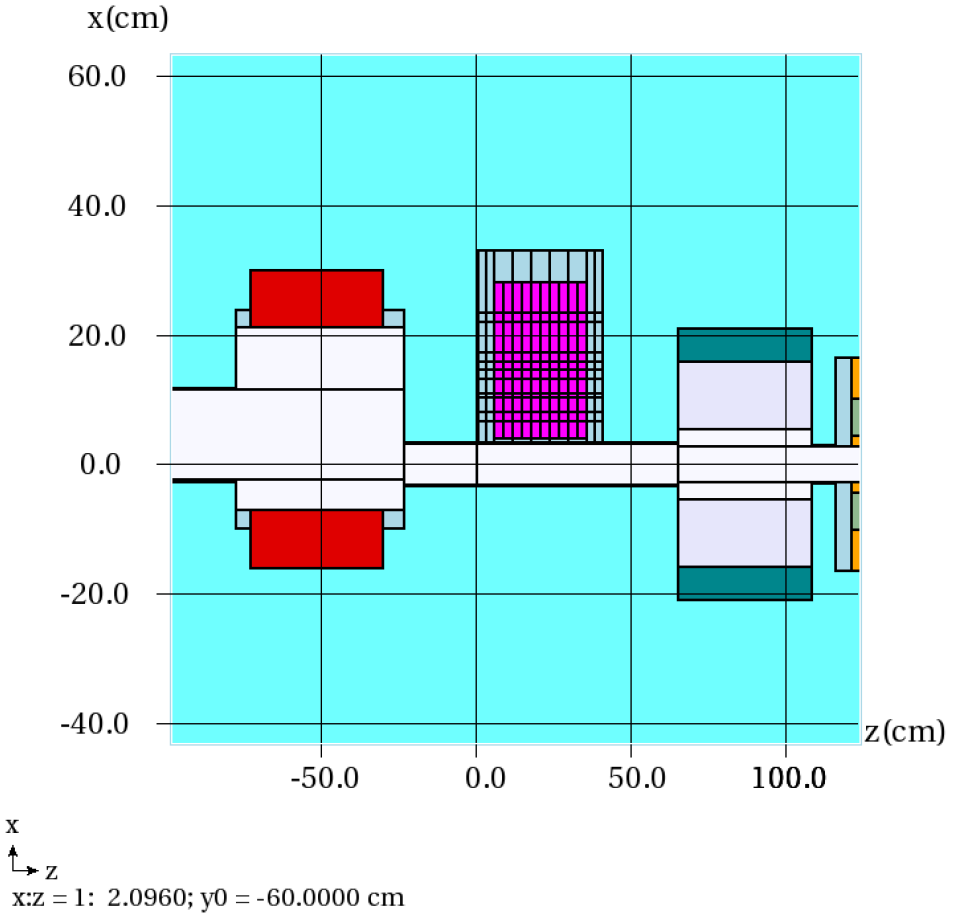
- MARS15 simulations: H^- : 1 p + 2 e^-, H^0: 1 p + 1 e^-
- Energy: 800 MeV or 700 MeV protons, 440 keV electrons

- BIA Models:

1. 30 cm tungsten + 10 cm stainless, 800 MeV, (170 W H^- + 30 W H^0)
2. 60 cm stainless + 20 cm marble, 800 MeV, (170 W H^- + 30 W H^0)
3. 60 cm stainless + 20 cm marble, 700 MeV, (149 W H^- + 27 W H^0)
4. 60 cm stainless + 20 cm marble, 800 MeV, (85 W H^- + 30 W H^0)
5. 60 cm stainless + 20 cm marble, 800 MeV, (30 W H^0)

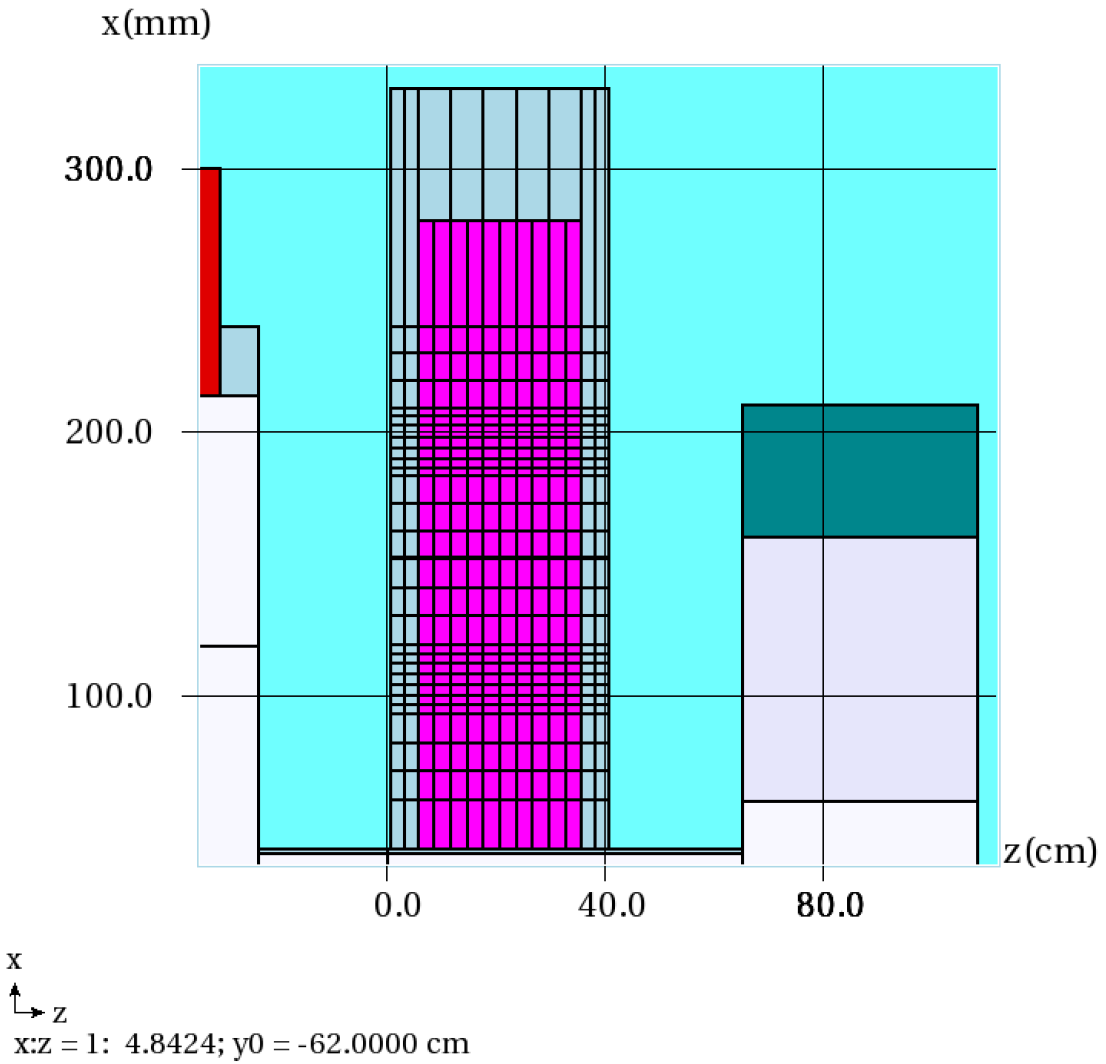
MARS15 BIA model: Initial state-of–the-art

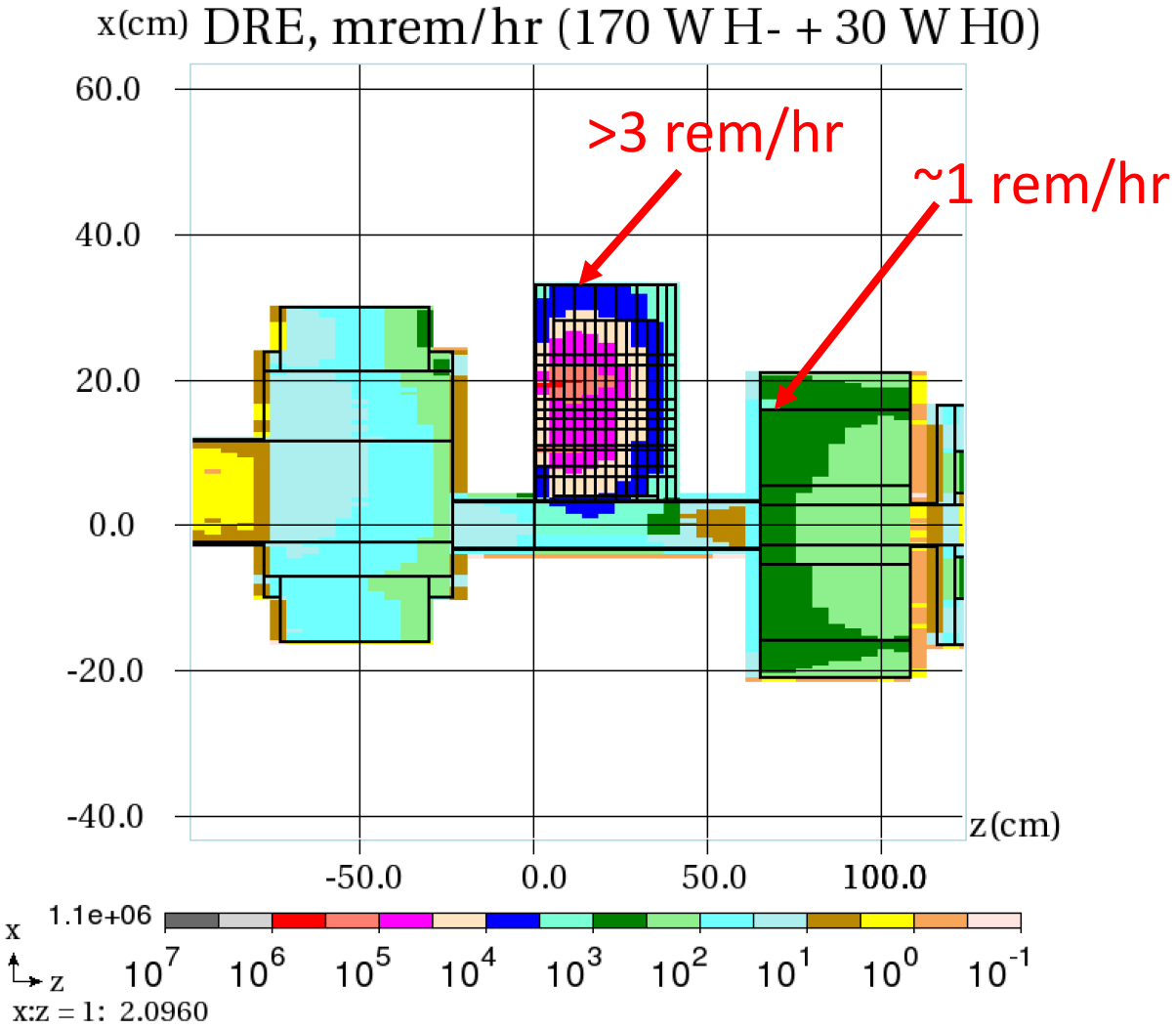




30-cm W core + 5-cm stainless (all sides)

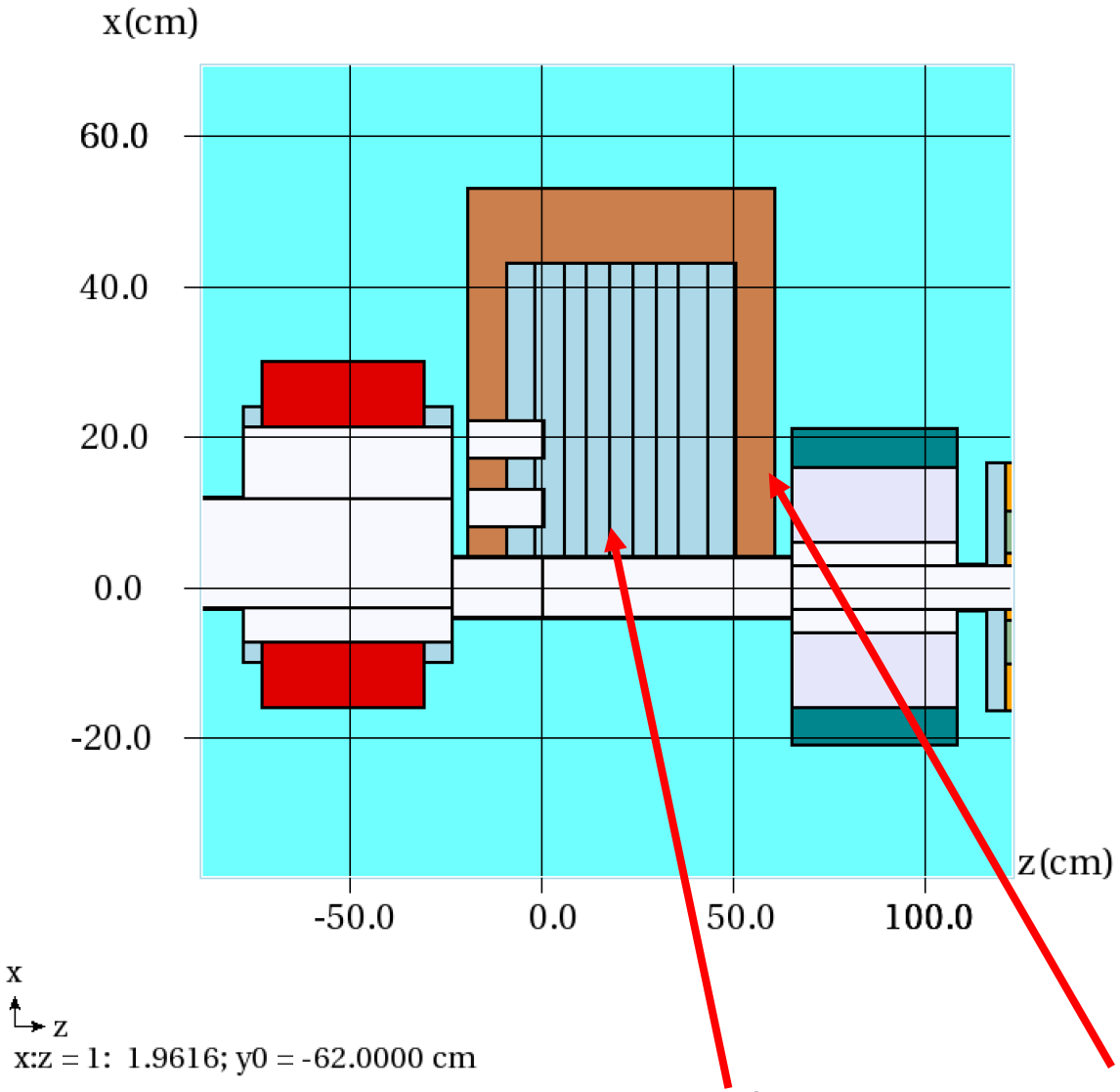
Model 1. Initial, tungsten core. 800 MeV

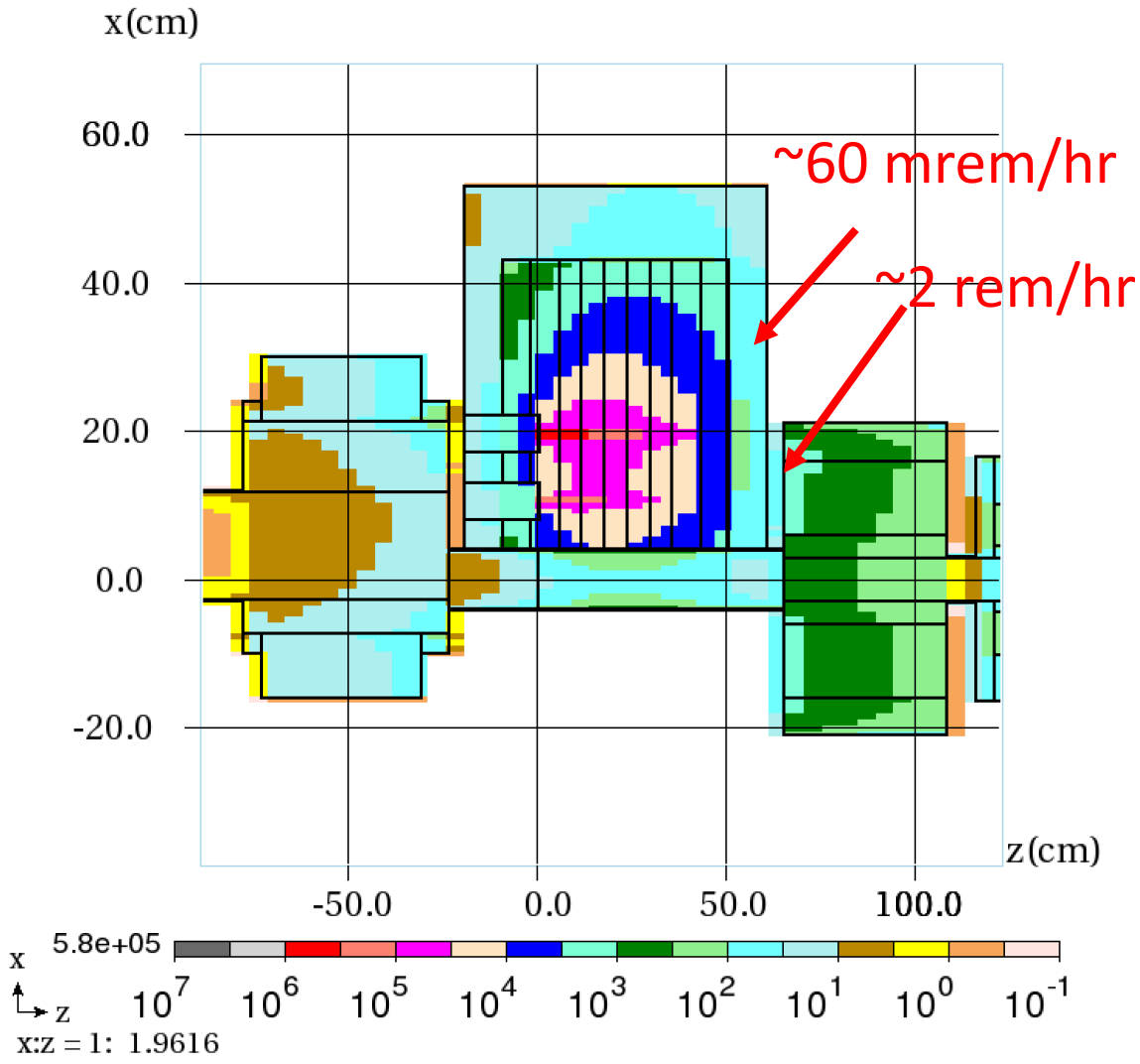




sigma(X)=1.9 mm; sigma(Y)=1.16 mm; X(H-)=19.6 cm; X(H0)=10.6 cm; Y=-62.4 cm

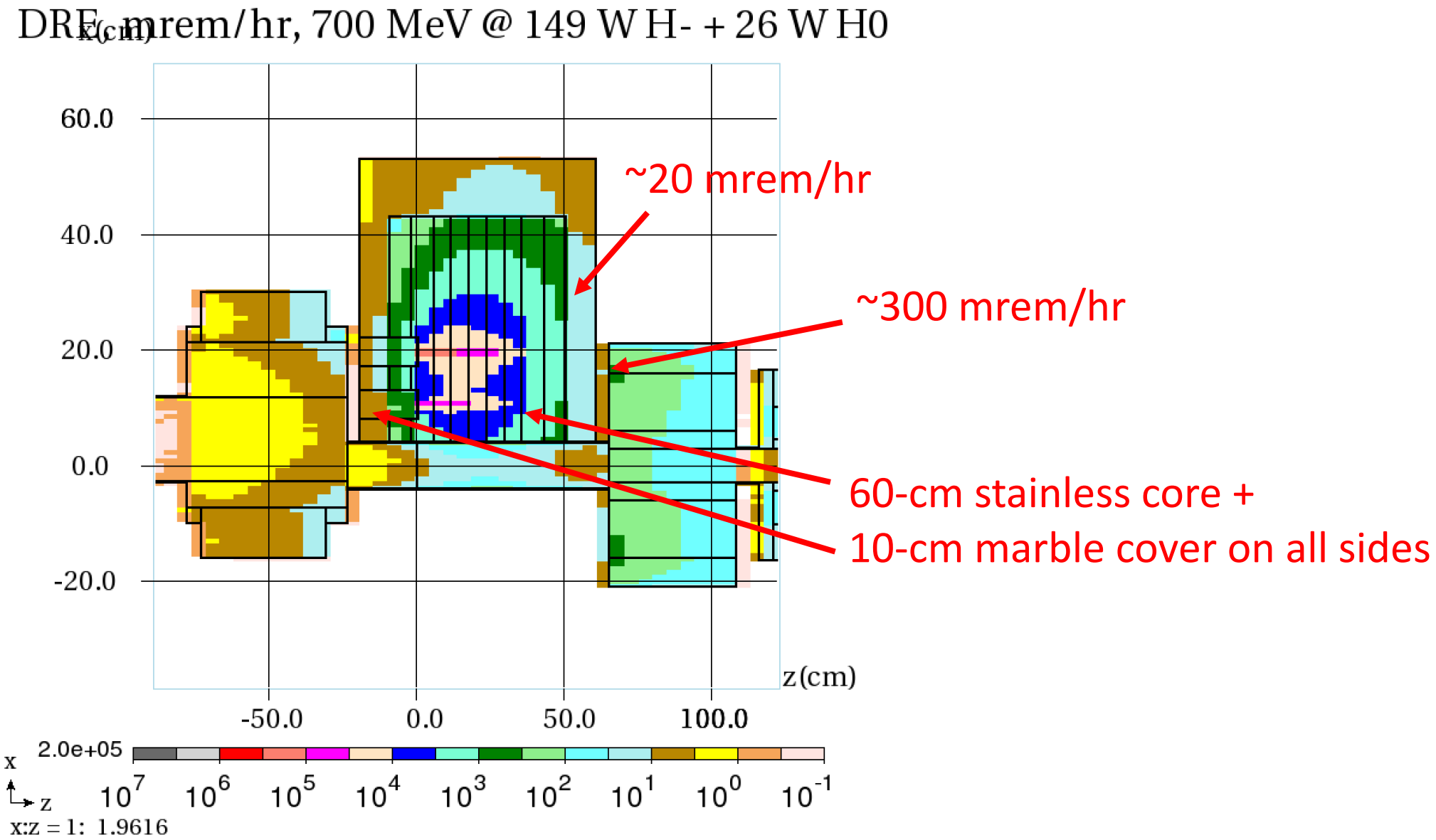
Model 2. Marble-covered stainless core, 800 MeV



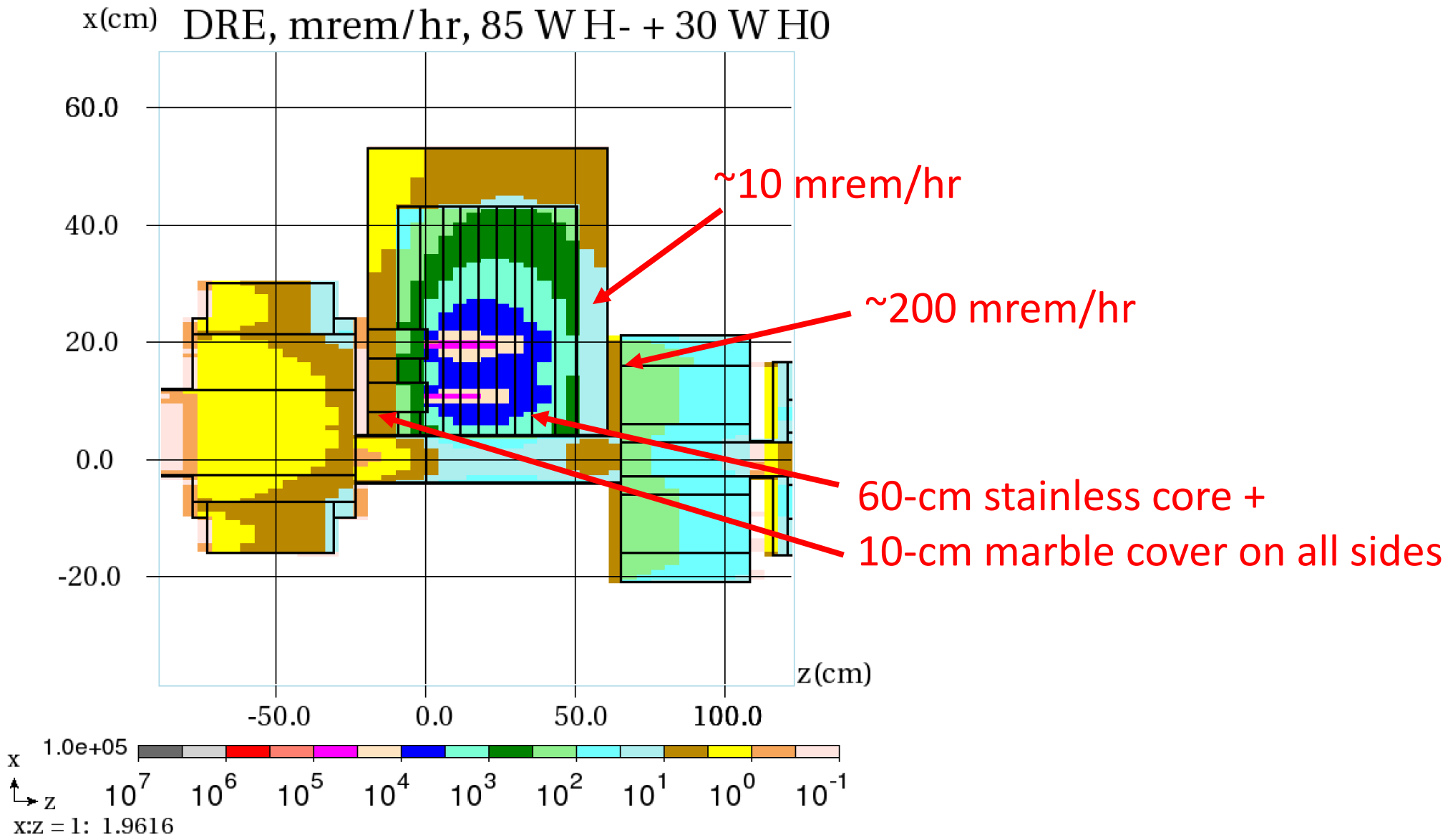


60-cm stainless core + 10-cm marble cover on all sides

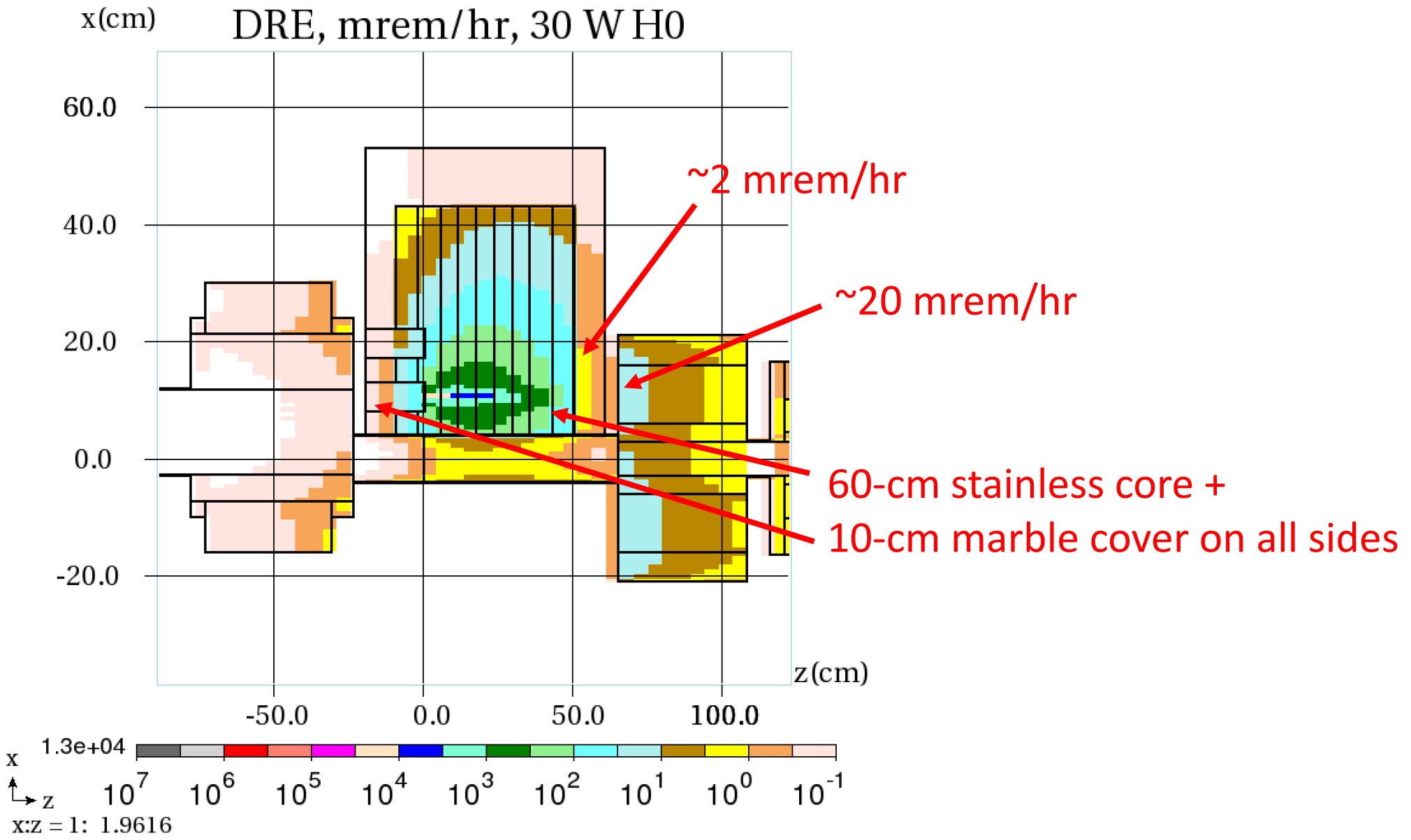
Model 3. Marble-covered stainless core, 700 MeV



Model 4. Marble, stainless, 85 W H-/ 30 W H0, 800 MeV



Model 5. Marble, stainless, 30 W H0, 800 MeV



Dose summary table

		Beam power, W		Peak residual dose, mrem/hr	
	Ekin(p), MeV	H-	H0	absorber	corrector
30cm W + 10cm SS	800	170	30	>3000	1000
60cm SS + 20 cm Marble	800	170	30	60	2000
60cm SS + 20 cm Marble	700	149	26	20	300
60cm SS + 20 cm Marble	800	85	30	10	200
60cm SS + 20 cm Marble	800	0	30	2	20

Conclusions

- All marble/stainless models satisfy dose limits for Absorber
- Only Model 5 (30 W H0) satisfies dose limits for both Absorber and Corrector
- Next steps:
- clear definitions of working and accidental modes
- possibilities of additional shielding for Corrector
- possibilities of reducing the absorber shielding
- Simulation plans:
- soil activation (star densities) for drinking/surface water, prompt doses, air activation, tunnel activation