KLF Design Meeting
October 17, 2024

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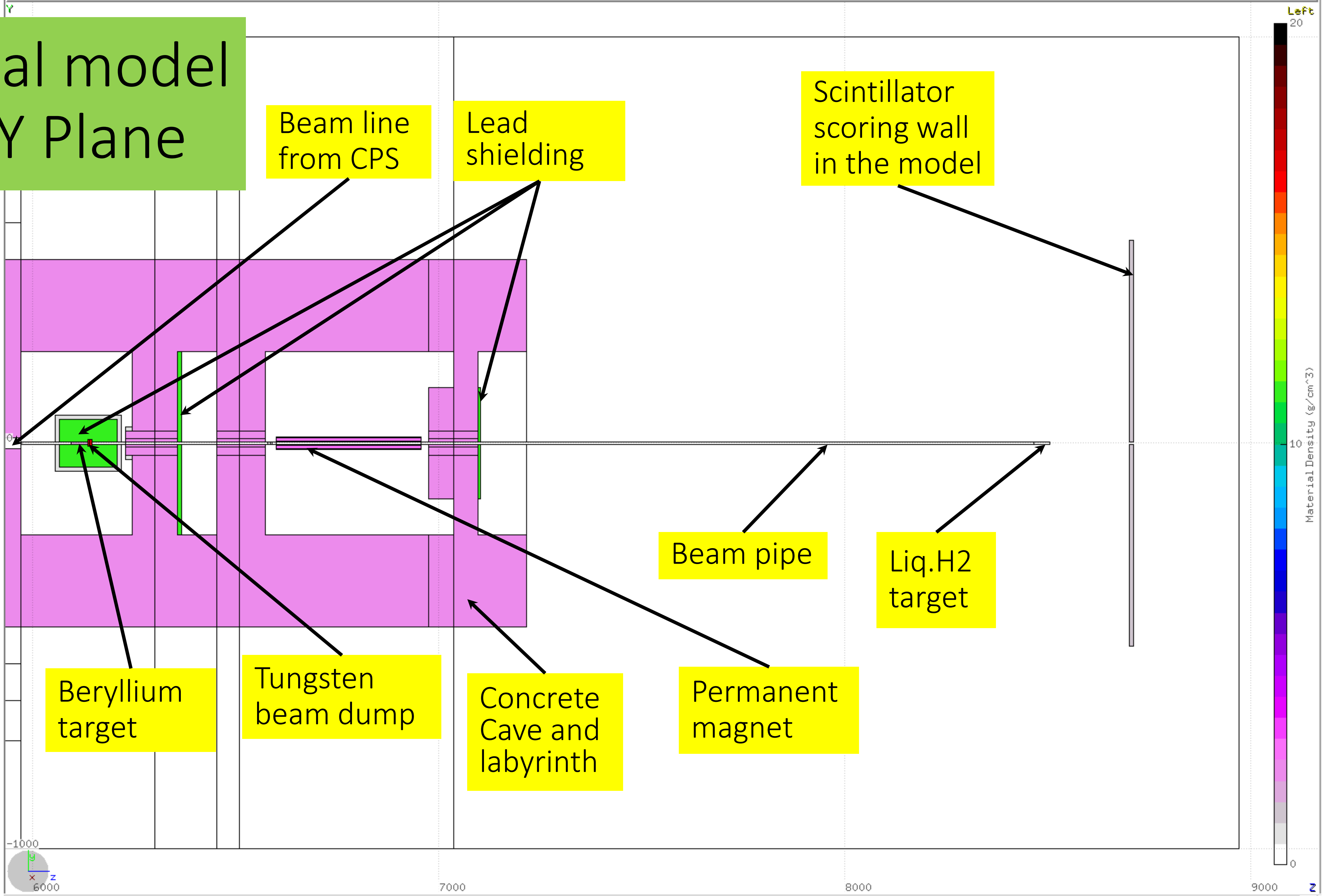
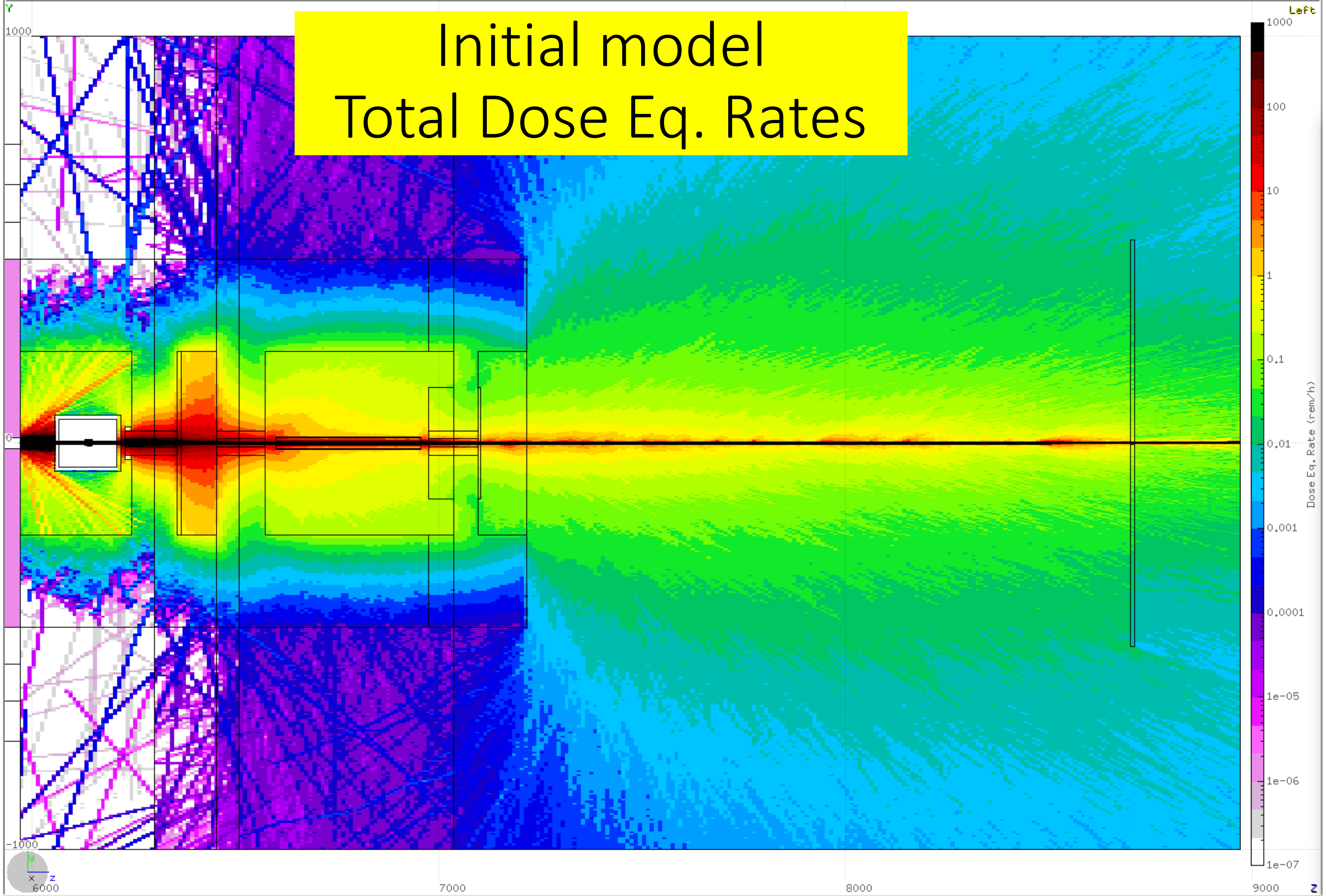
KLF Model Update – October 17th, 2024

- Continuing with efforts to understand high count rates in GlueX
- Possible sources of the noise
    - Low-energy photons hitting the target (seems to be not the case)
    - High-energy forward-streaming particles penetrating through the concrete around the beam line in the Cave Labyrinth walls
        - Using heavy materials around the pipe in the walls would help, but not enough
    - New observation: high-energy particles in the beam hitting the pipe and producing radiation around
        - Beam originates at any point at the tungsten block exit face.
        - Angular spread larger than the target aperture
        - The beam will continue to hit the pipe at any distance
        - Collimation can only be limited, and at the expense of aperture
        - The cascades in the wall produce background in the detectors
- Trying to address the issues and find ways to optimize the solution:
    - Use Cu10W90 heavy core around the beam line close to the Beryllium target
    - Use extra iron cores in the second and third walls
    - Shield the beam line in the Hall (either using thick-wall beam pipe, or installing the shielding around the pipe)
- FLUKA modeling is performed in the full range of energies (from thermal for neutrons, 1 MeV production and transport for anything else). Using cross section biasing for the photonuclear reactions and geometry regions biasing for shielding penetration calculations.

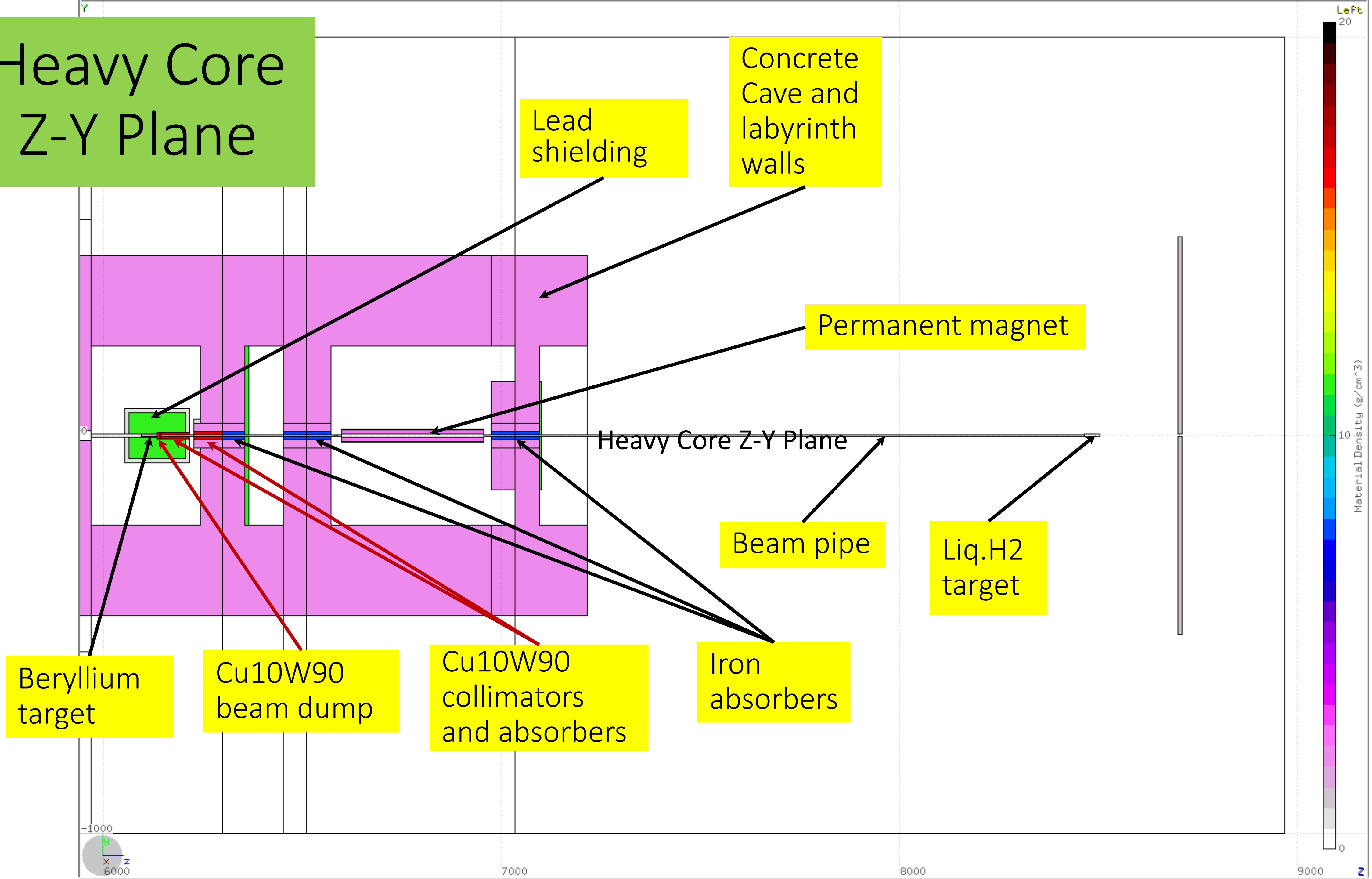
Initial model Z-Y Plane



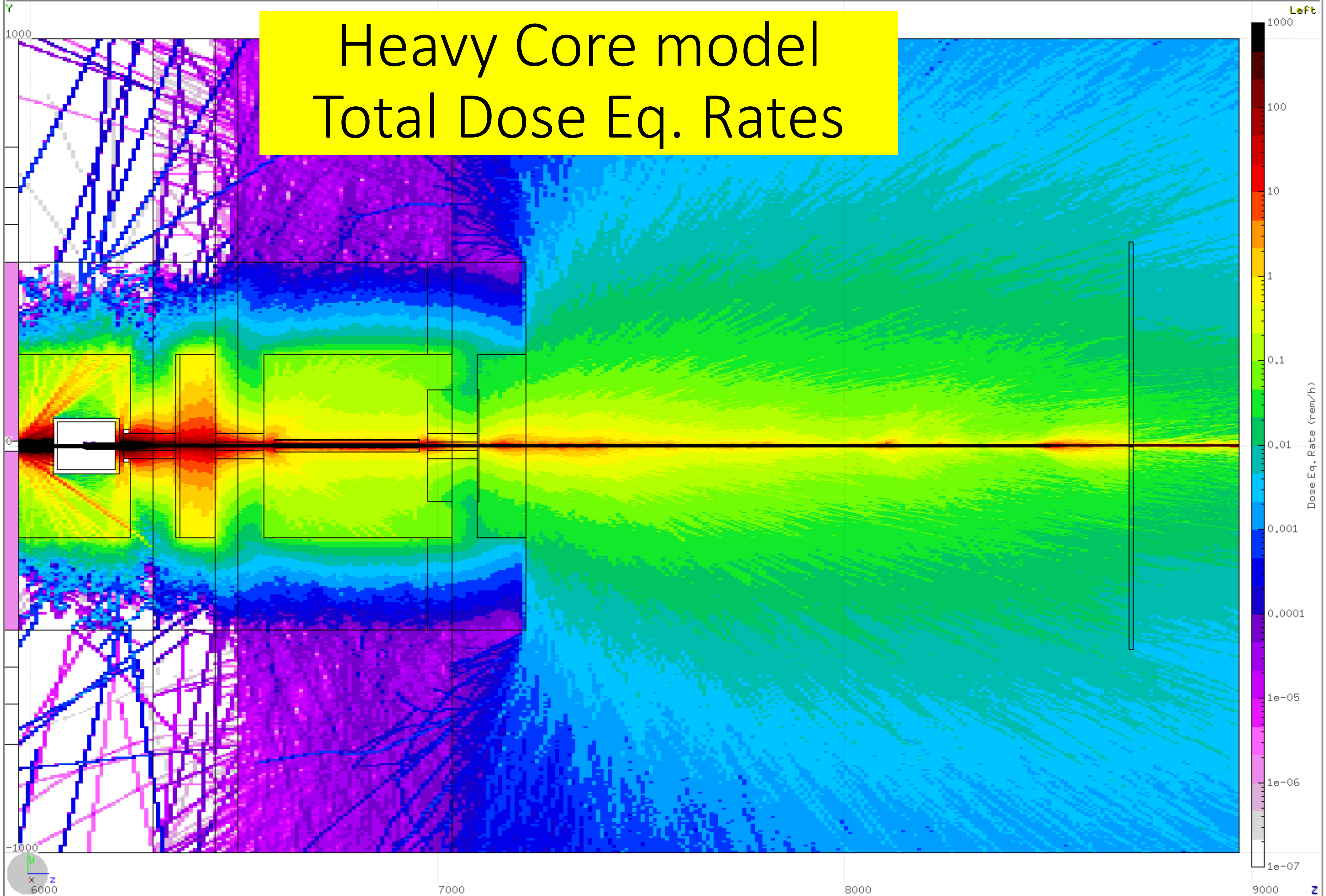
Initial model Total Dose Eq. Rates



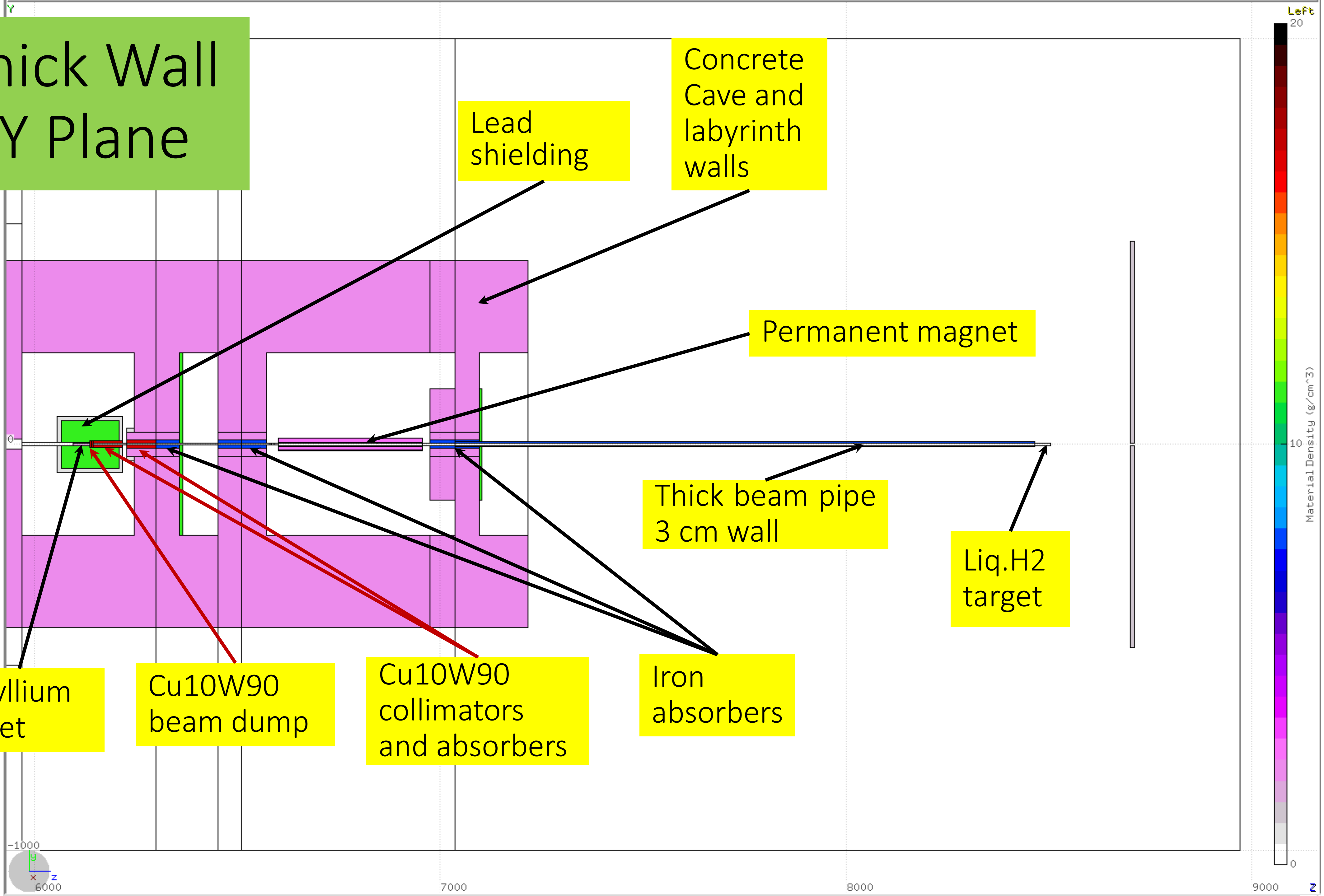
Heavy Core Z-Y Plane



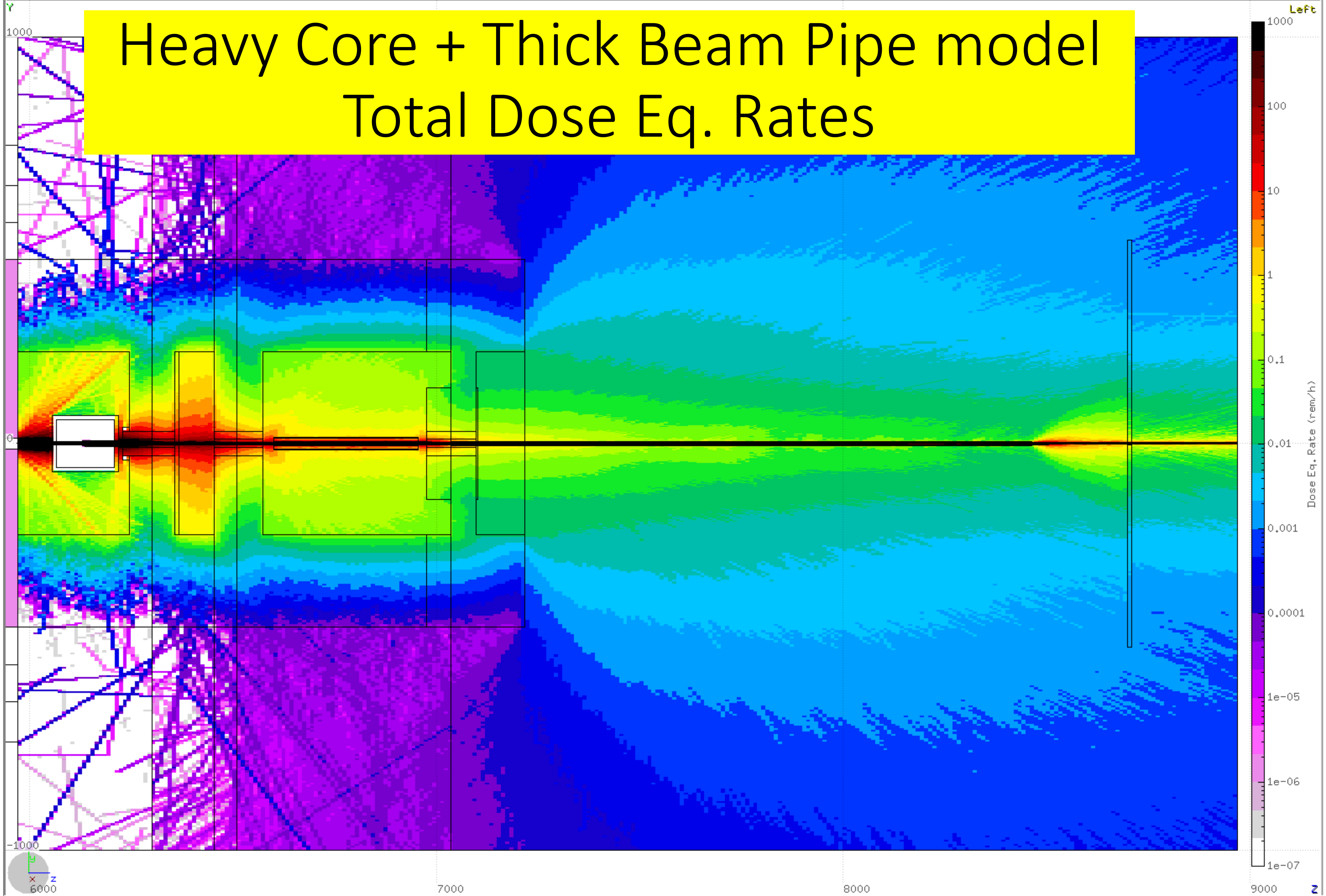
Heavy Core model
Total Dose Eq. Rates



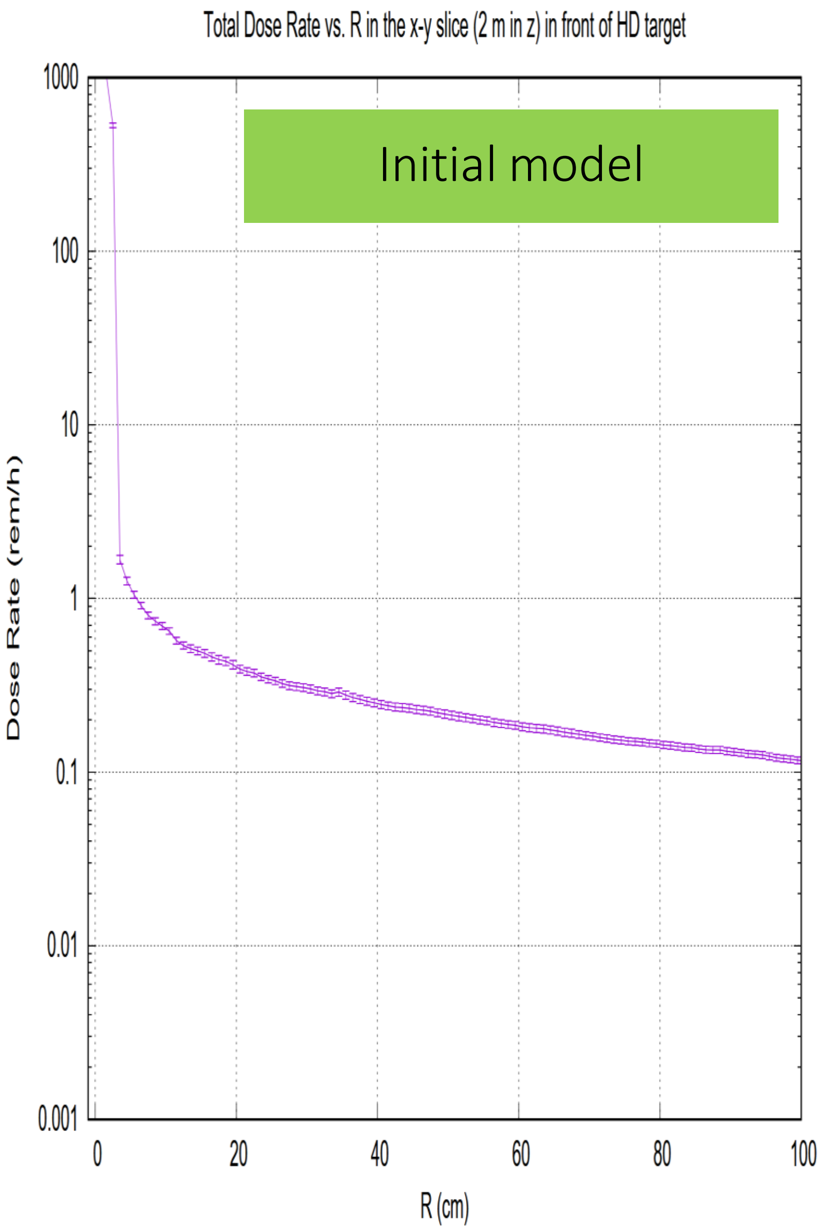
+Thick Wall Z-Y Plane

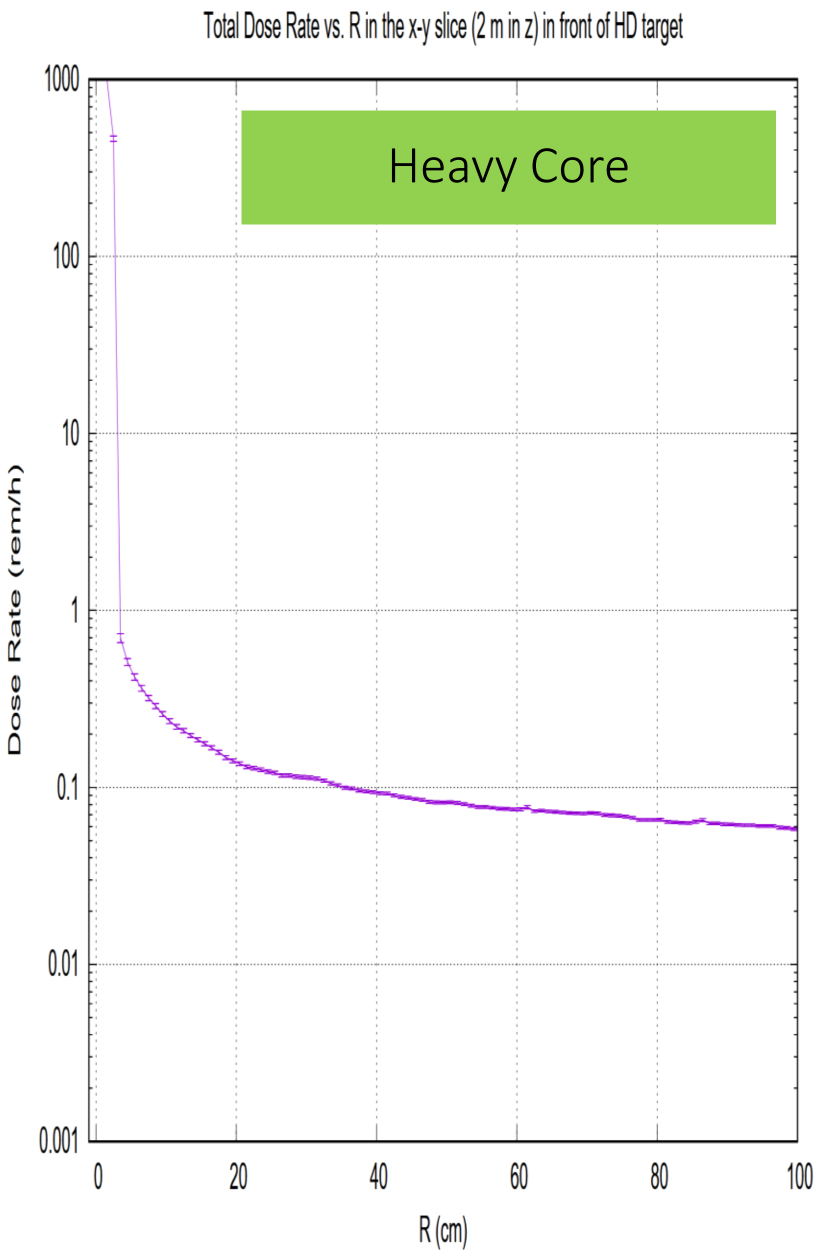


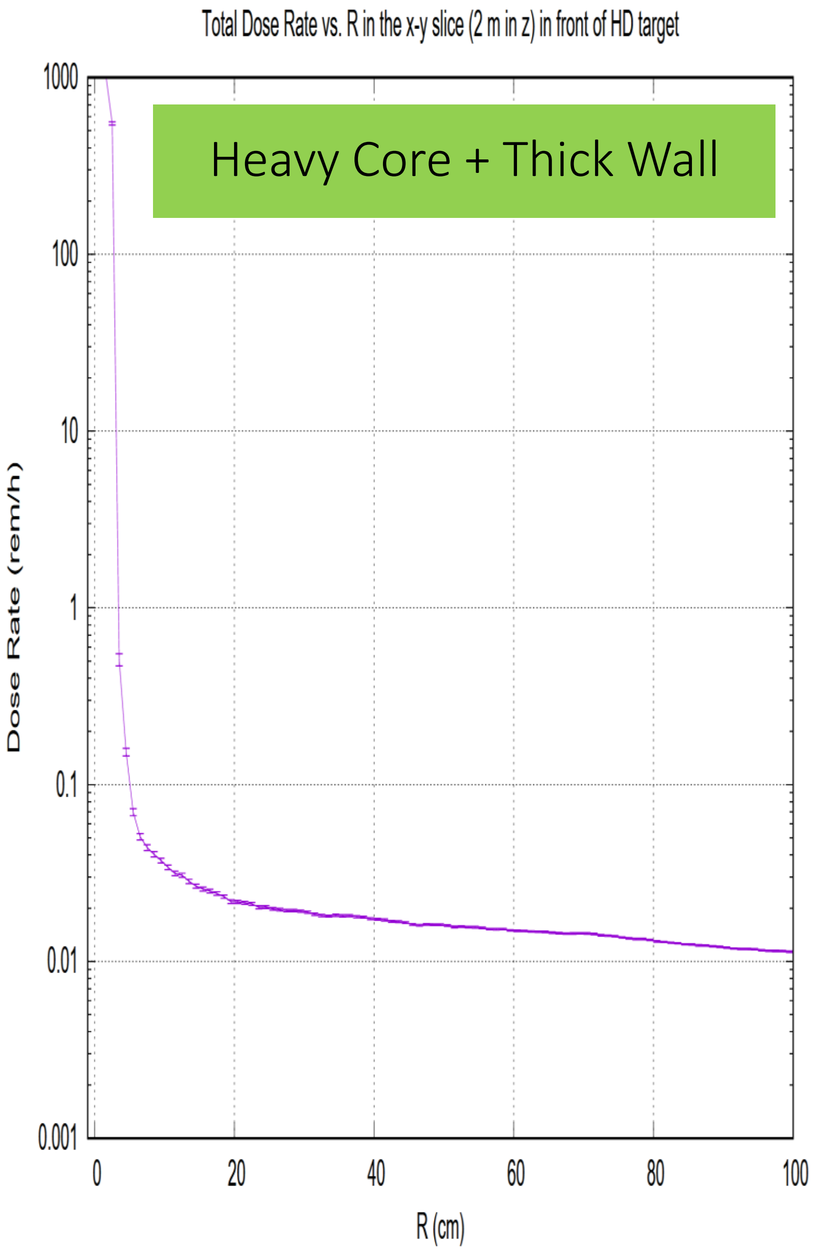
Heavy Core + Thick Beam Pipe model
Total Dose Eq. Rates



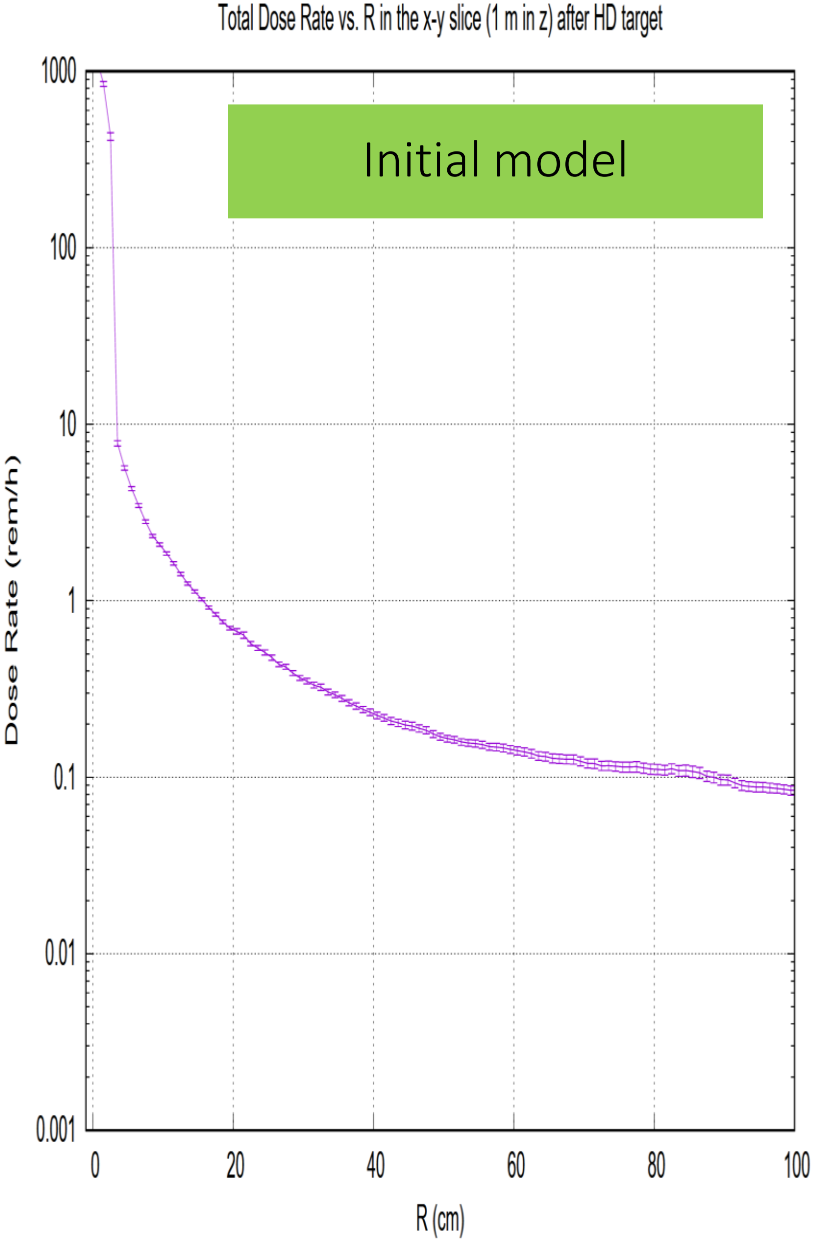
Dose-Eq Rate function of R, 2 m z-slice in front of target

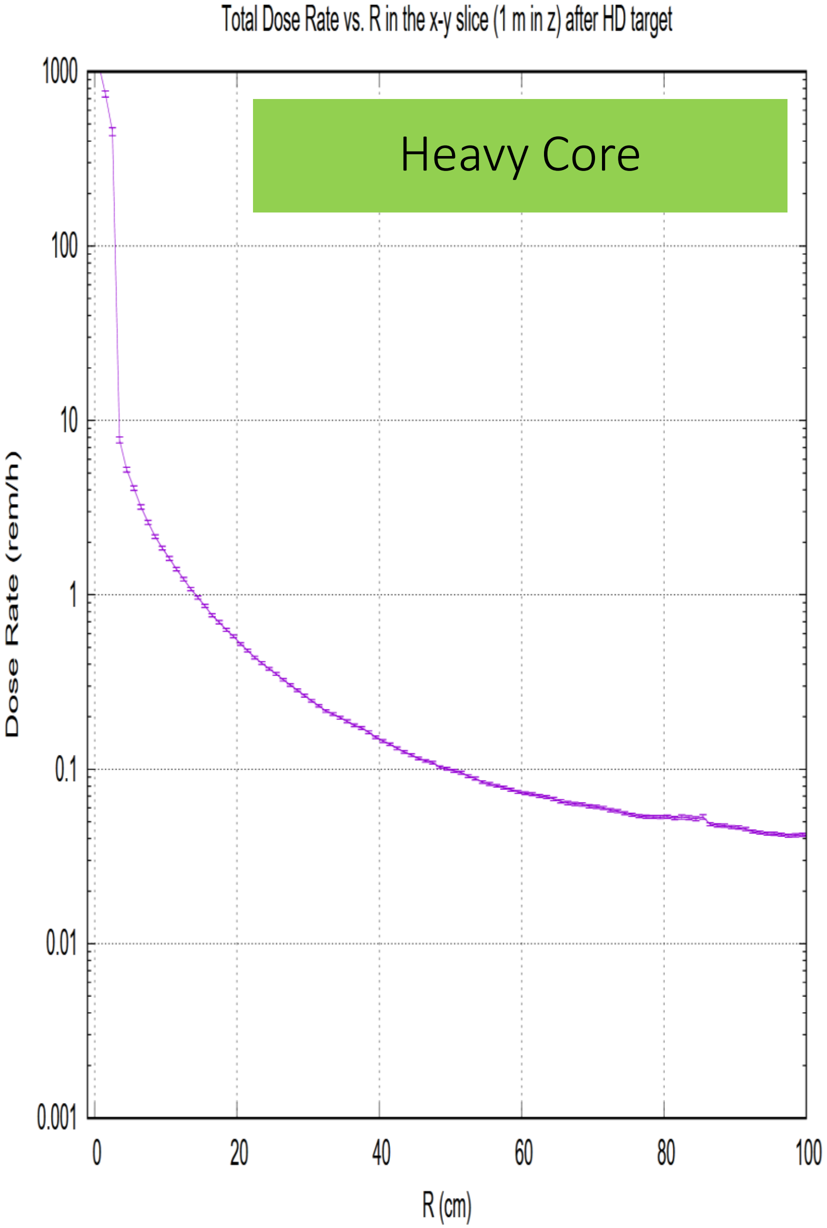


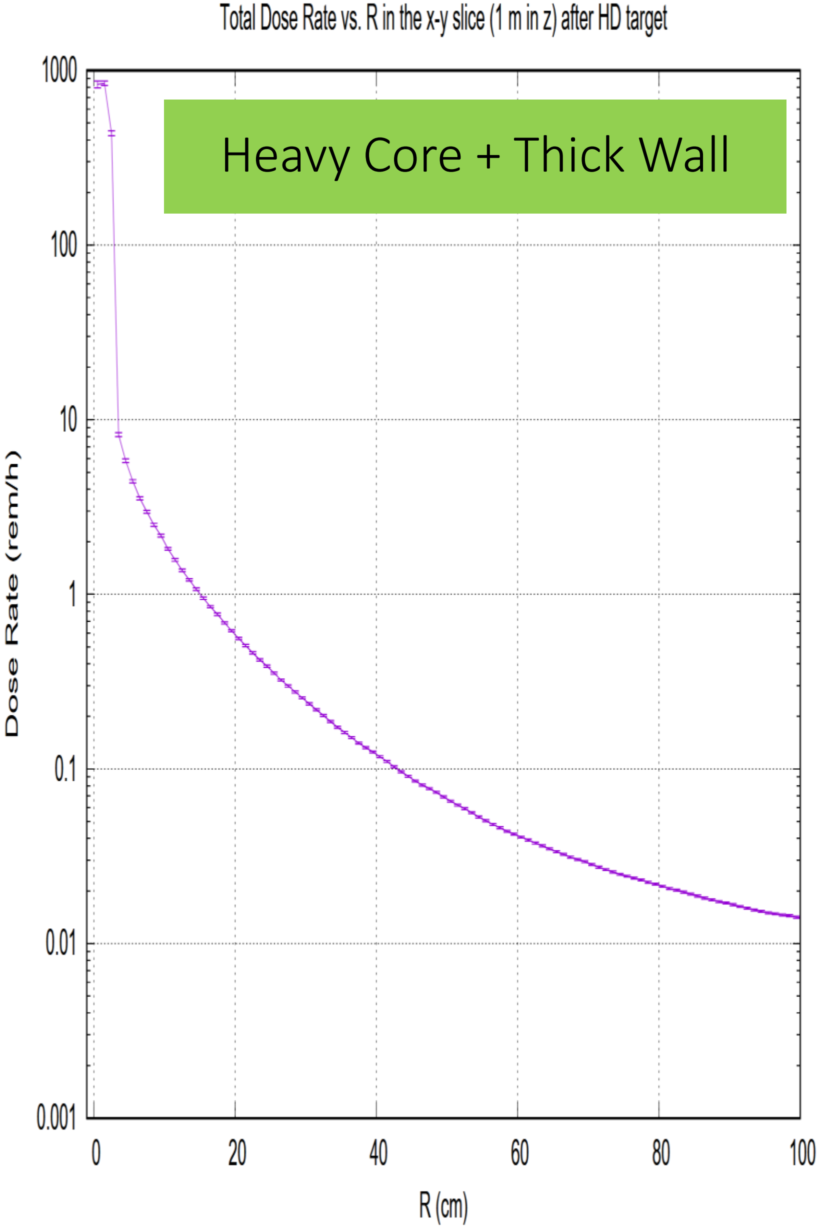




Dose-Eq Rate function of R, 1 m z-slice after target







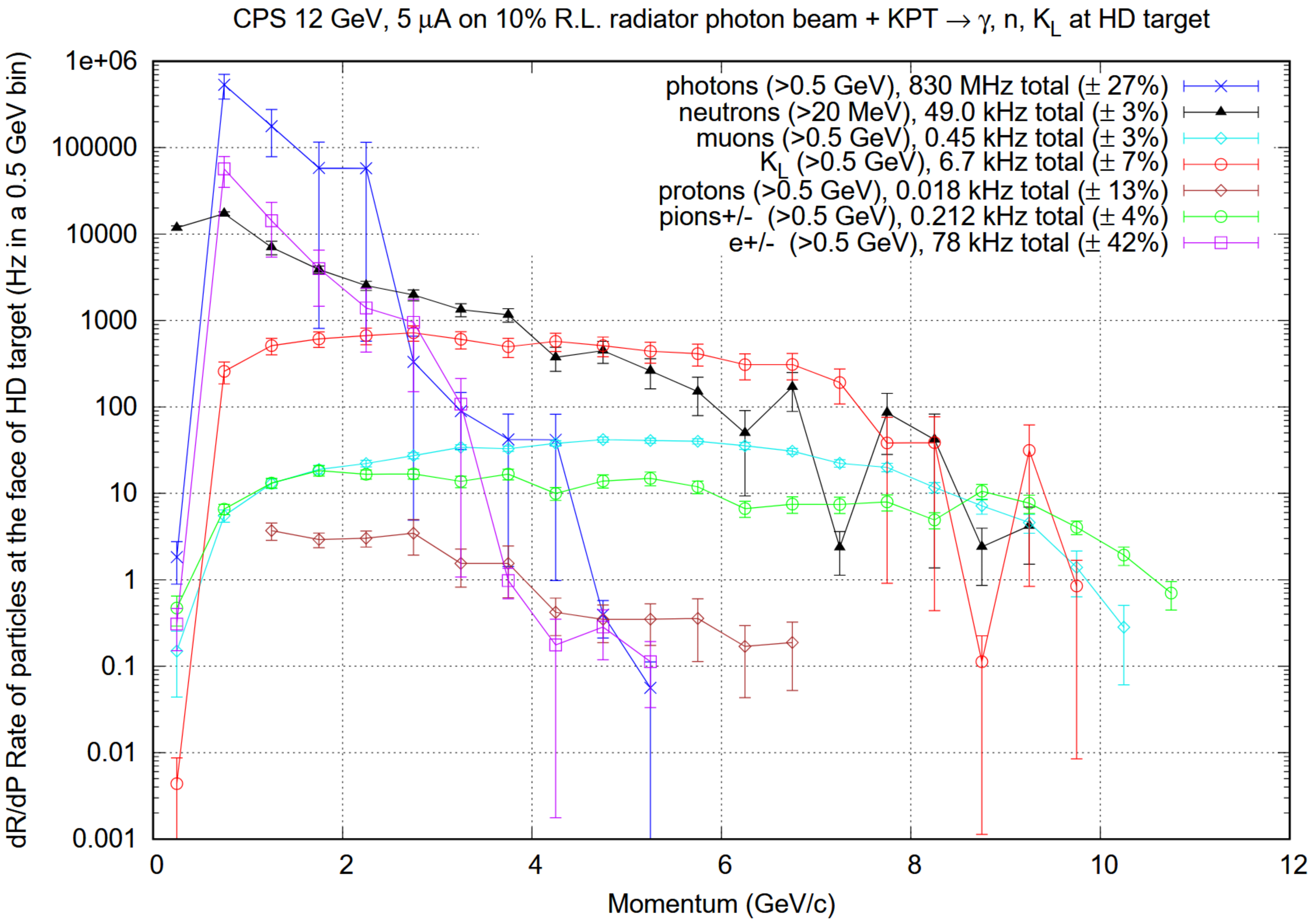
Target Count Rates

High model threshold

Low model threshold:

~1 MHz n
~3 GHz γ

- At lower particle energies



Highlights – October 17th, 2024

- Continuing with efforts to understand high count rates in GlueX, trying to address the issues and find ways to optimize the solution
- The methods of heavy material shielding around the beam pipe in the Cave, and the method of shielding of the beam pipe in the Hall work to suppress dose rates in GlueX detectors.
- Correct implementation in the model the Pair Spectrometer magnet would help somewhat.
- The optimization parameters will also include the thickness of the Tungsten dump after Beryllium target, beam apertures, and possibly varying the radiator thickness