

Mikhail Kostin

Beam Line Activation Due to Black Body Radiation Stripping

Fermilab

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Model

- Main Injector pipe. Elliptical cross-section.
- Thickness 0.065”.
- Protons 8 GeV.
- The protons enter the pipe wall from inside at an angle of 2 mrad.
- Vertical Gaussian distribution with $\sigma=1.333$ mm.
- Uniformly distributed along the z-axis.
- Beam loss rate is 10^8 proton/meter.

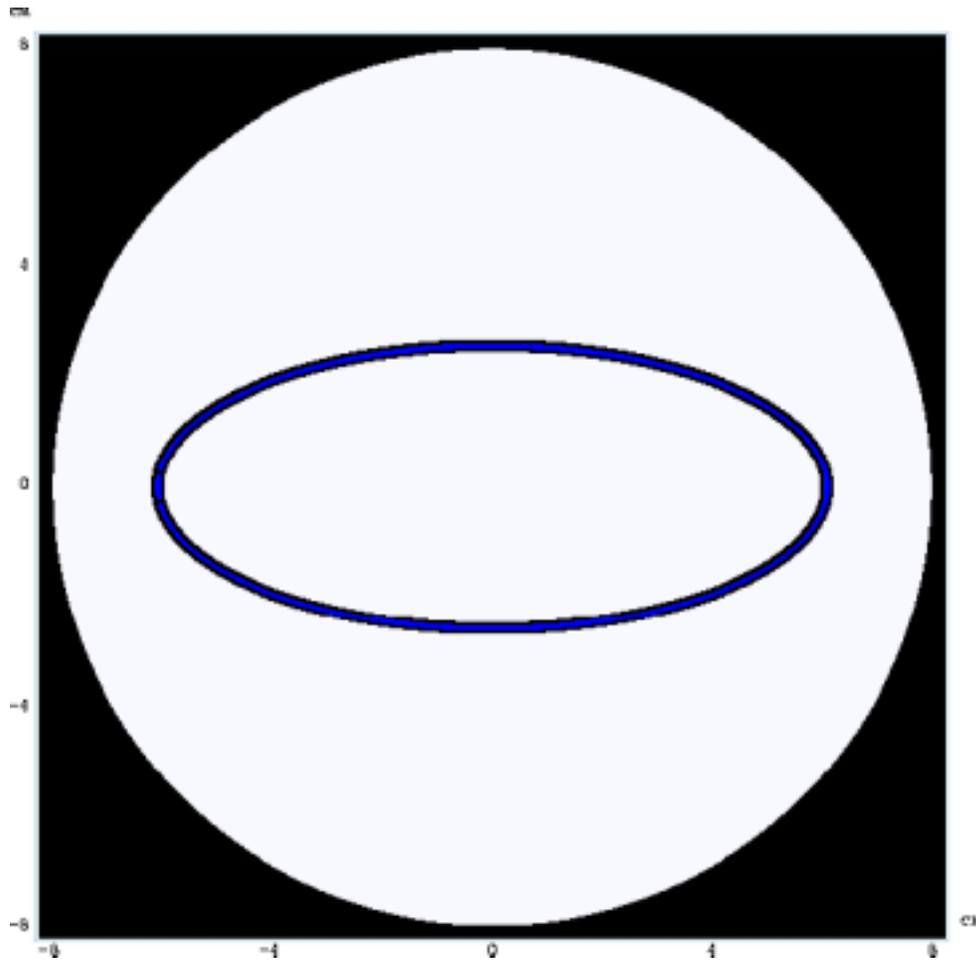


Figure 1: Pipe cross-section.

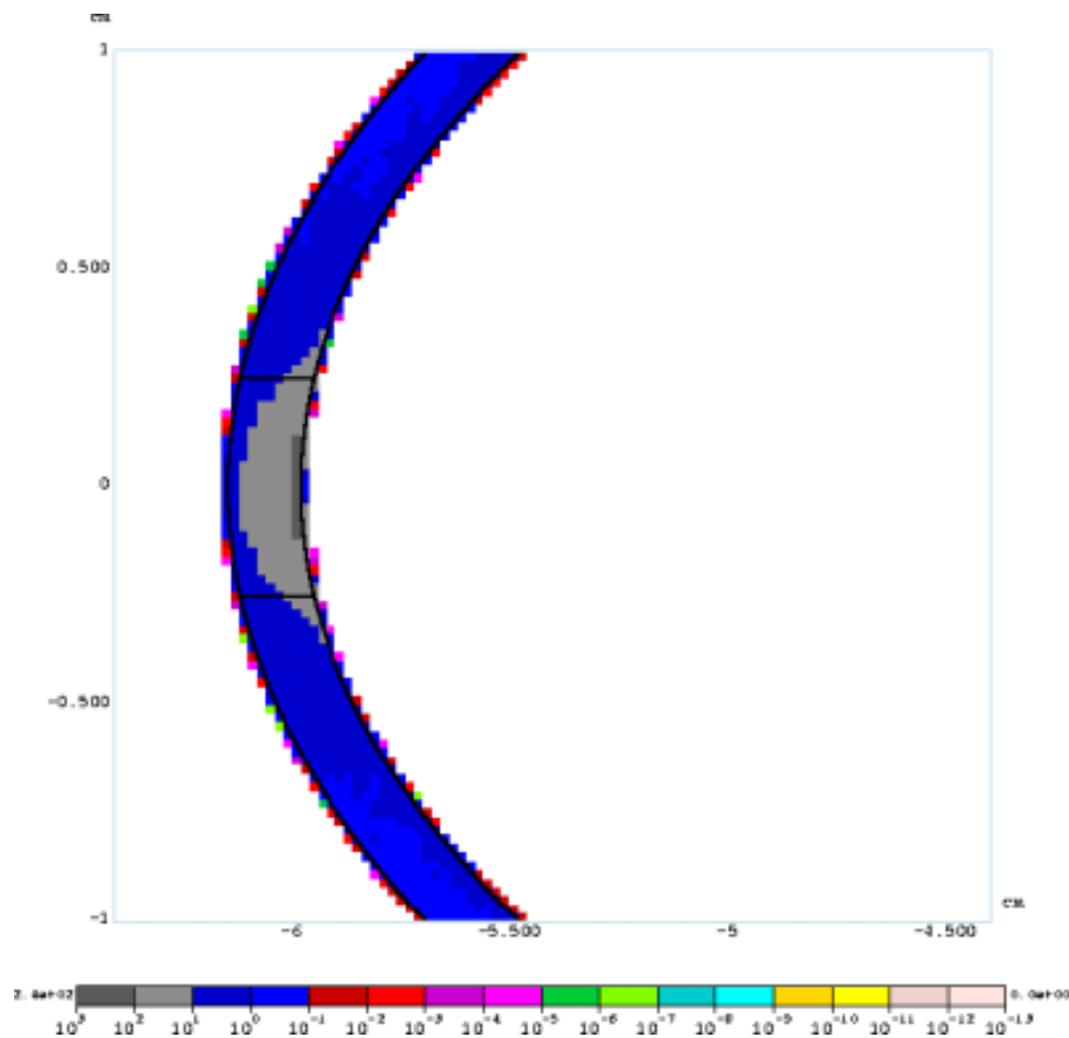


Figure 2: Residual activation distribution.

Doses as calculated by MARS

- Maximal dose on contact (0 cm/30 days/1 day) averaged over a small volume (± 0.25 cm vertically)
3443 \pm 26 mrem/hr
- Dose averaged over the rest of the pipe
80 \pm 0.002 mrem/hr

Correction geometry factor ~ 3 (from Nikolai)

Doses after correction

- Maximal dose on contact
 ~ 1 rem/hr
- Residual dose averaged over the rest of the pipe
 ~ 30 mrem/hr