Fermi National Accelerator Laboratory

FERMILAB-TM-1927

Calculated Dose Rates in Halls Using CASIM

Allan Sondgeroth

Fermi National Accelerator Laboratory
P.O. Box 500, Batavia, Illinois 60510

February 1995

Operated by Universities Research Association Inc. under Contract No. DE-AC02-76CHO3000 with the United States Department of Energy

Calculated Dose Rates in Halls Using CASIM

Allan Sondgeroth
February 27, 1995

The first part of this document shows the results of a series of CASIM runs designed to optimize the size of a steel cylinder so as to produce the highest density of stars at any given radius perpendicular to beam direction. Figure one shows the geometry used.

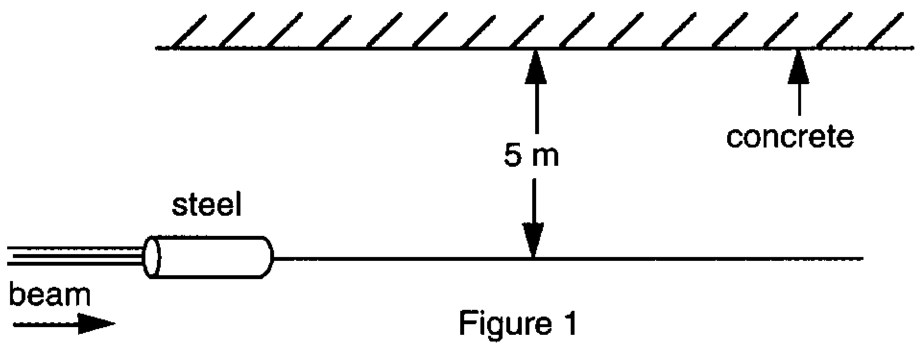


Figure 1

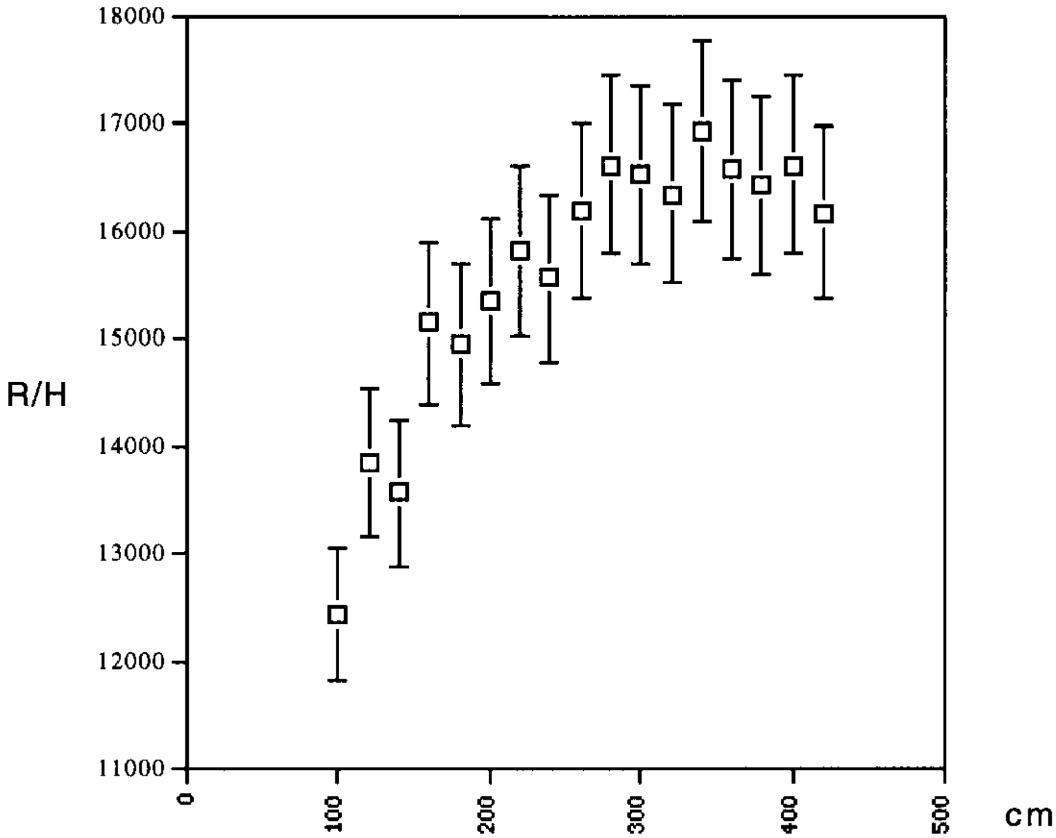
For the first set of runs the radius of the cylinder was fixed at six centimeters(r=6) and the length was increased by 20 centimeters each run. Column one, of the following table, shows the length of the steel cylinder. Column two shows where the peak dose is along the beam direction and column three shows what the dose is in that range. The dose is calculated by multiplying the peak machine intensity(3.6E13 ppp) by the number of machine cycles per hour(60cycles/hour) by a conversion factor from star density to mrem for concrete(0.009 mrem/[star/cm^3]) by the peak star density. This calculation has an error bar of five percent.

Length(cm)	Peak in z Range(m)	Dose(R) at 5m
100	8-9	12434
120	9-10	13836
140	9-10	13564
160	9-10	15140
180	8-9	14945
200	8-9	15354
220	11-12	15820
240	6-7	15567

260	7-8	16190
280	9-10	16618
300	10-11	16521
320	8-9	16346
340	9-10	16930
360	7-8	16579
380	8-9	16424
400	9-10	16618
420	9-10	16171

Table 1

The following is the data from table one shown in graph form.



Graph 1

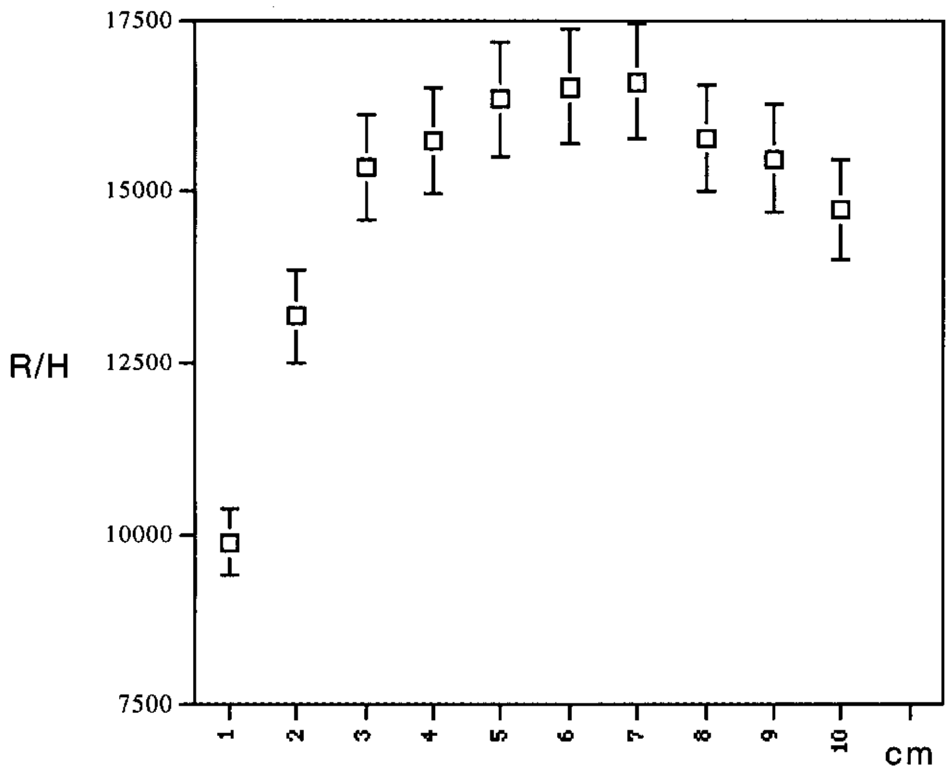
The data shows the optimum length for our cylinder to be in the three to four meter range.

For the next set of runs the length of the cylinder is now fixed at three meters and we vary the radius.

Radius(cm)	Peak in z Range(m)	Dose(R) at 5m
1	15-16	9885
2	13-14	13174
3	11-12	15354
4	9-10	15743
5	8-9	16346
6	10-11	16521
7	9-10	16599
8	7-8	15781
9	6-7	15490
10	6-7	14731

Table 2

The following is the data from table two shown in graph form.



Graph 2

These runs show that a cylinder with a radius of seven centimeters produces the highest dose rate. For the rest of the CASIM runs a cylinder three meters long with a radius of seven centimeters will be used.

Using our optimized cylinder we now make runs using geometries more closely representing real experimental hall geometries in an atempt to predict possibly dose rates. Figure two shows a geometry similar to that of the KTev hall.

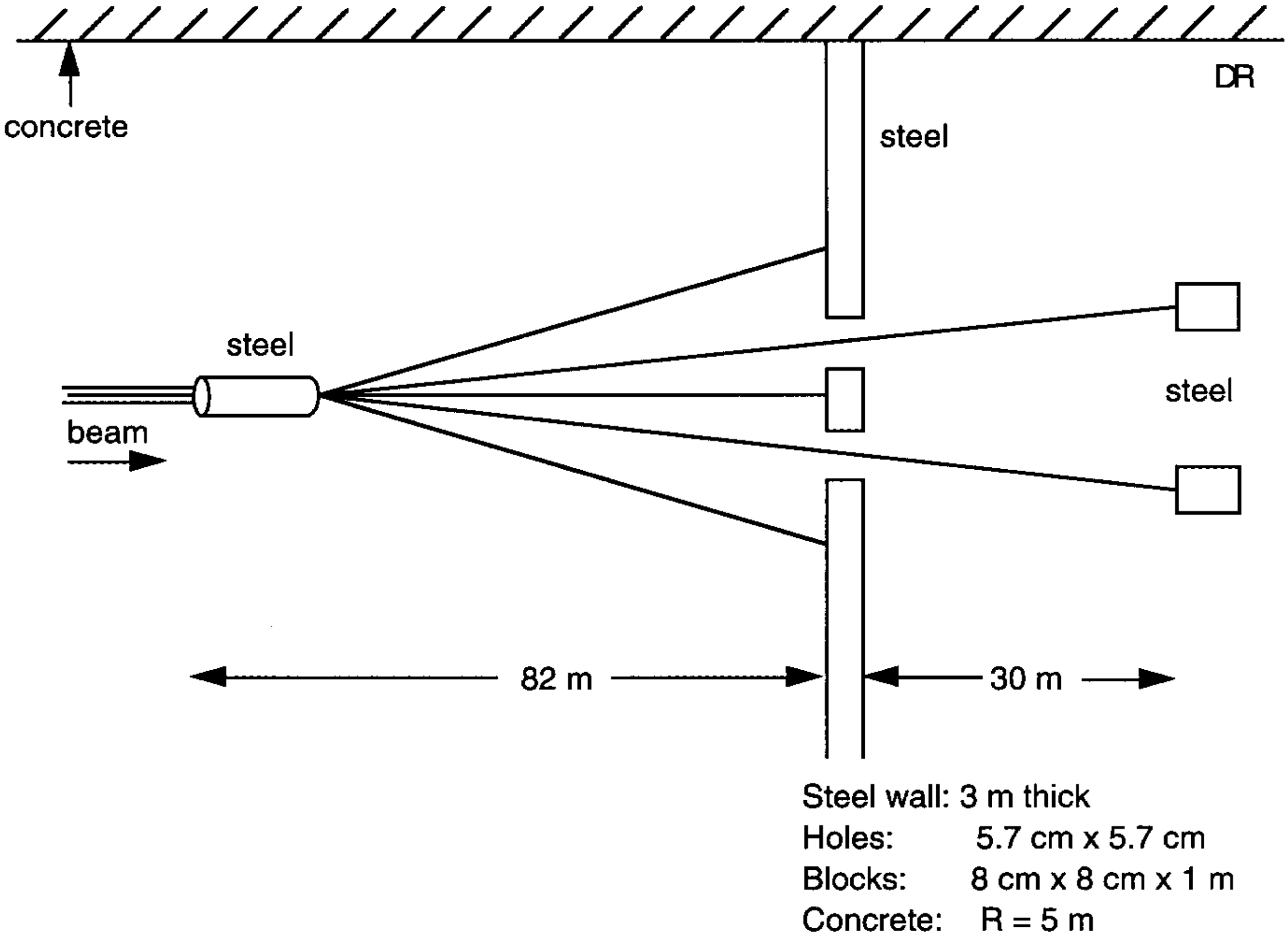


Figure 2

Downstream of the steel wall, at the conrete, the highest dose rate calculated was 15.2 mrem/h approximately eleven meters from the steel wall.

Figure three shows a similar case except with a single hole and a single block centered around the beam axis.

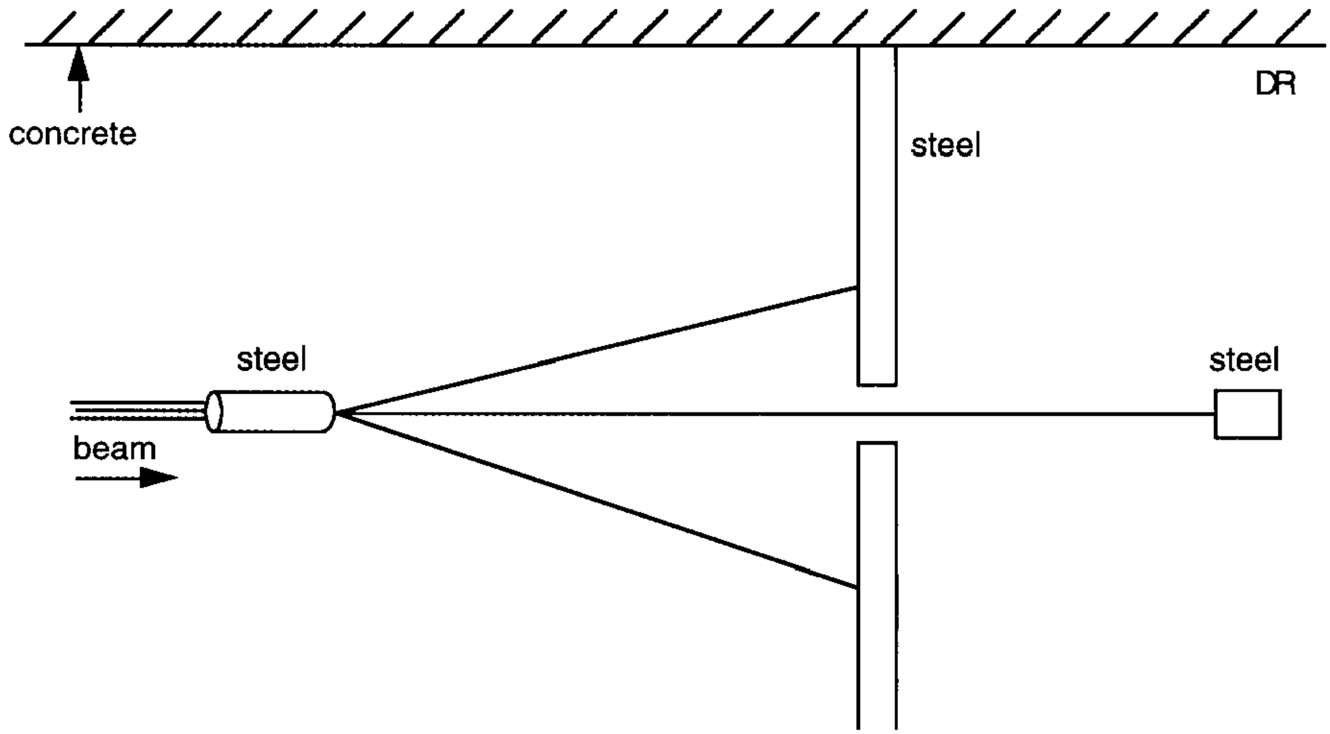


Fig. 3

Downstream of the steel wall, at the conrete, the highest dose rate calculated was 16.78 mrem/h approximately seventeen meters from the steel wall.