In Toward Tissue Penetration by MRI-powered Millirobots Using a Self-Assembled Gauss Gun paper, there are four parameters that can be optimized to get the maximum energy from a gauss gun they are: Radius of the sphere (r), Inter component spacing (a), intra component spacing (s) and the number of components in the barrel stage (n). This paper presents how to design a gauss gun with the optimal configuration for r, a, s and n given the length of the whole gaussian gun (L) and the width (W).

To find the optimum values, I ran more than 1000 iterations for L = 10, 20 and 50 cm with r= 1% L- 9%L for each value of L, after that for each value of r I ran iterations with different n values, then for each value of n I tested it with different a = kr and s=mr, which makes the total length exactly equal to L using Mathematica. From the collected data we studied changes with respect to r, n, the ratio between a and s and the ratio between a and r. Knowing that the equations that we used in this paper are:

L = 4r + 1.5a + n[4r+s+a]+4r+s (1), (2) and -

The collected data shows that the maximum for each stage for specific radius occurred when s/a close to zero, and for specific L occurred when r = 8.3%L with the ratio s/a approximately equal to zero and n=1, these results don’t change whatever the value for L.

Table.1 shows the maximum for each r as a percentage of L assuming that the ratio s/a equal to zero, from this table you will notice that the optimum configuration happened when r = 8.3% L with n = 1 and a/r = 0.019277 and s/a 0.

Note that whatever the value of L is these values stay the same.

|  |  |  |  |
| --- | --- | --- | --- |
| r as a percentage of L | maximum number of n applicable for each r% | a/r | s/a |
| 1% | 23 | 0 | 0 |
| 2% | 10 | 0.173913 | 0 |
| 3% | 6 | 0.177778 | 0 |
| 4% | 4 | 0.181818 | 0 |
| 5% | 3 | 0 | 0 |
| 6% | 2 | 0.190476 | 0 |
| 7% | 1 | 0.914286 | 0 |
| 8% | 1 | 0.2 | 0 |
| 8.30% | 1 | 0.019277 | 0 |

Table.1 Gaussian gun optimum parameters for each r as a percentage of L.

The following is the plot for L = 0.5 applying the table on it

