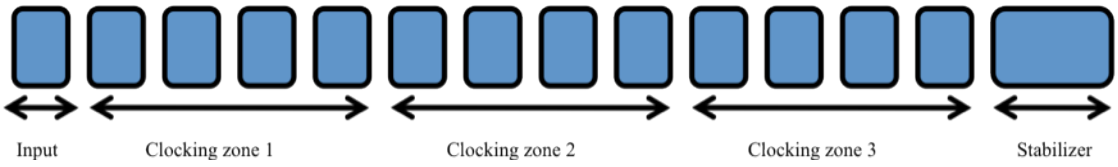
NDnano Undergraduate Research Fellowship (NURF)
2011 Project Summary

Student name: Kobena Ampofo
Faculty mentor name: X. Sharon Hu
Project title: Exploring Power and Delay Tradeoffs in Lines of Nanomagnets

This project attempted to address the problem of how many magnets one can put in a zone in a line of nanomagnets. This is integral in attempting to optimize the propagation of a signal through the line of magnets as a longer line might experience better anti-ferromagnetic coupling but need higher threshold field strength.

The simulation method involves mainly using OOMMF as the environment. The layout is to put a driver magnet at the head of the line, then decide how many magnets per zone will be simulated. Once an equal number of magnets have been set for each zone, a block is placed at the end for stability and to account for having more zones past the end of the line. We chose to use a 3-phase clock as previous papers explained that that was the most optimal in a comparison of 2, 3, and 4 phase clocks. Each magnet is 60 x 90 x 10 and the layouts range from 7 - 25 magnets (2 devices per zone all the way up to 8). We found that a general trend occurs in terms of the minimum field strength (i.e., power) needed to correctly propagate a signal to the end of the line, as well as the minimum time (i.e., delay) necessary to propagate the signal at higher field strengths. While a line with more magnets in a zone requires higher power and longer delay, they tend to exhibit more constructive coupling which, at times, can lower the necessary field strength needed and sometimes allow faster per-magnet nulling and switching, hence lowering the delay.



Example of a 4 devices per zone layout