# Magnetic Fields Generated By Magnets Moving Along Epicyclic Paths

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## Abstract

Knowing the magnetic fields generated by an assembly of magnets in epicyclic motions are important in designing magnetrons for physical vapor deposition (PVD) applications [1]. Epicyclic paths would mean all magnets are rotating in an orbital (central) axis, on top of which each magnet is rotating about its own planetary axis. In this study, we demonstrate an approach to calculate the time-dependent magnetic field generated by two horseshoe magnets in such epicyclical motion. Curvilinear Coordinates interface was first employed to set up the different magnetization configurations in the magnets. Magnetic Fields, No Currents and Deformed Geometry interfaces were then used to model magnets moving in epicyclic paths. We perform simulations with two types of magnetization configurations in the horseshoe magnets, namely magnetizations along the length of the magnets (please see animation [2]) and in the lateral directions (please see animation [3]). Results reveal that for magnets with lateral magnetization, gentler variations and thus more uniformity in magnetic field magnitudes are observed on a plate placed below the magnets. Our approach would be of interest for future design of magnetrons for PVD applications.

## Reference

1. M. A. Miller et.al, Patent US6841050 B2 (2005).
2. http://www.pitotech.com.tw/Magnetic%20Configuration%201.gif
3. http://www.pitotech.com.tw/Magnetic%20Configuration%202.gif

## Figures used in the abstract

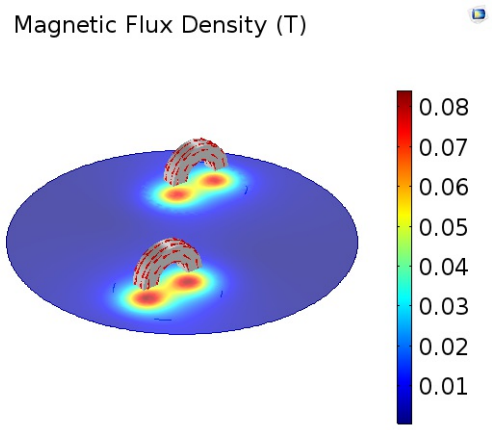


**Figure 1**: Modelling magnets moving along epicyclic paths