

Off-axis magnetic field calculation

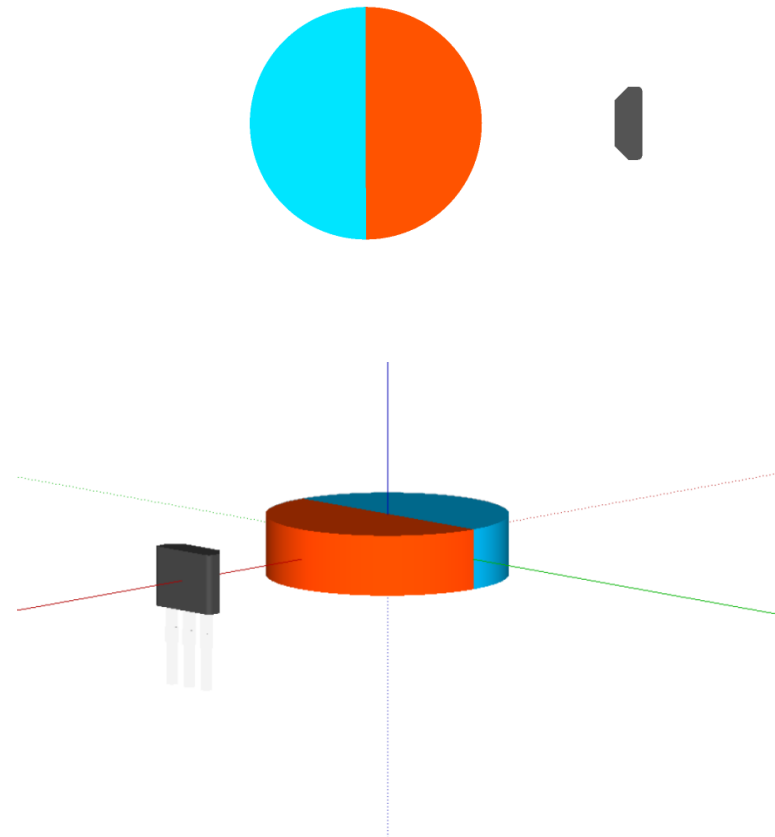
TI Precision Labs – Magnetic Position Sensing

Presented by Dan Harmon

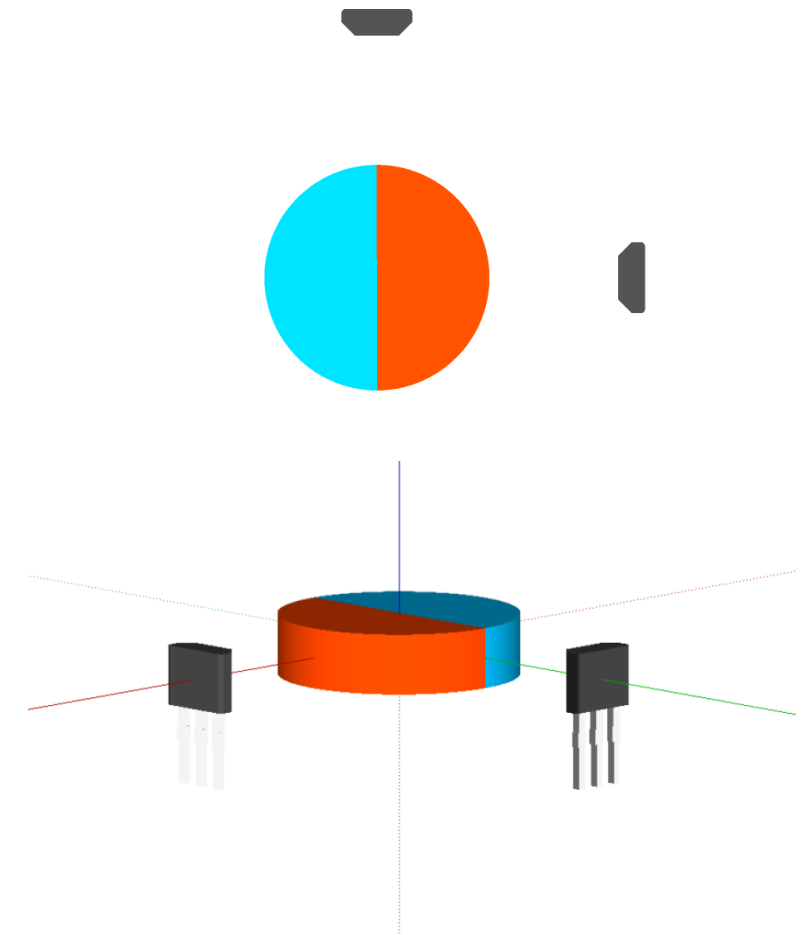
Prepared by Mitch Morse

Where off-axis matters

One sensor angle measurement

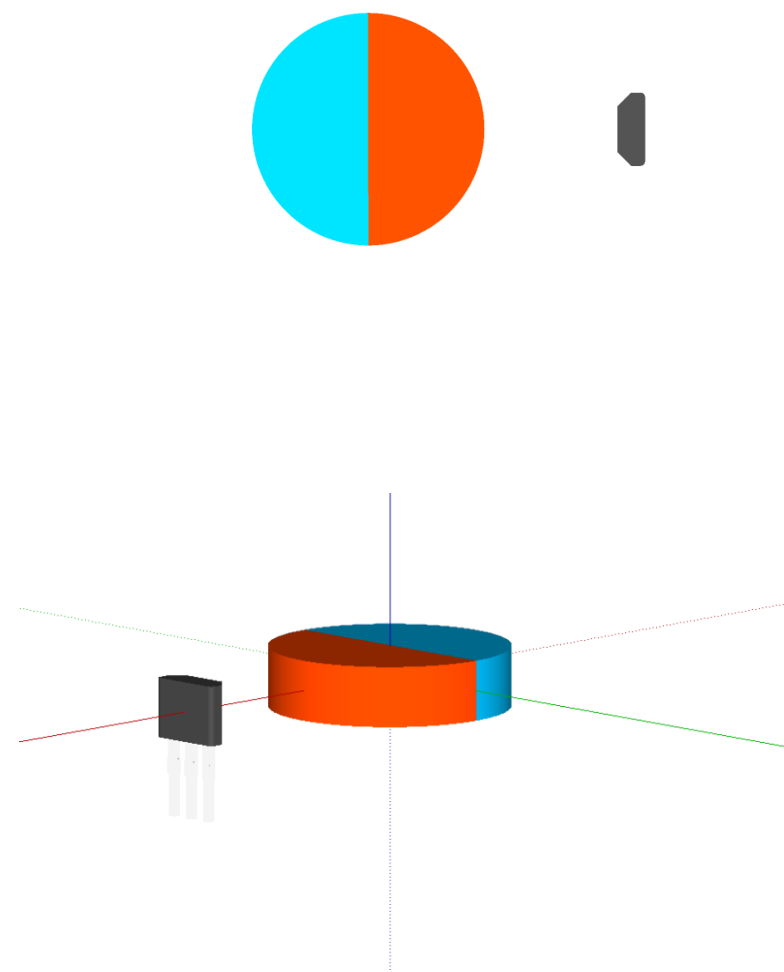


Two sensor angle measurement

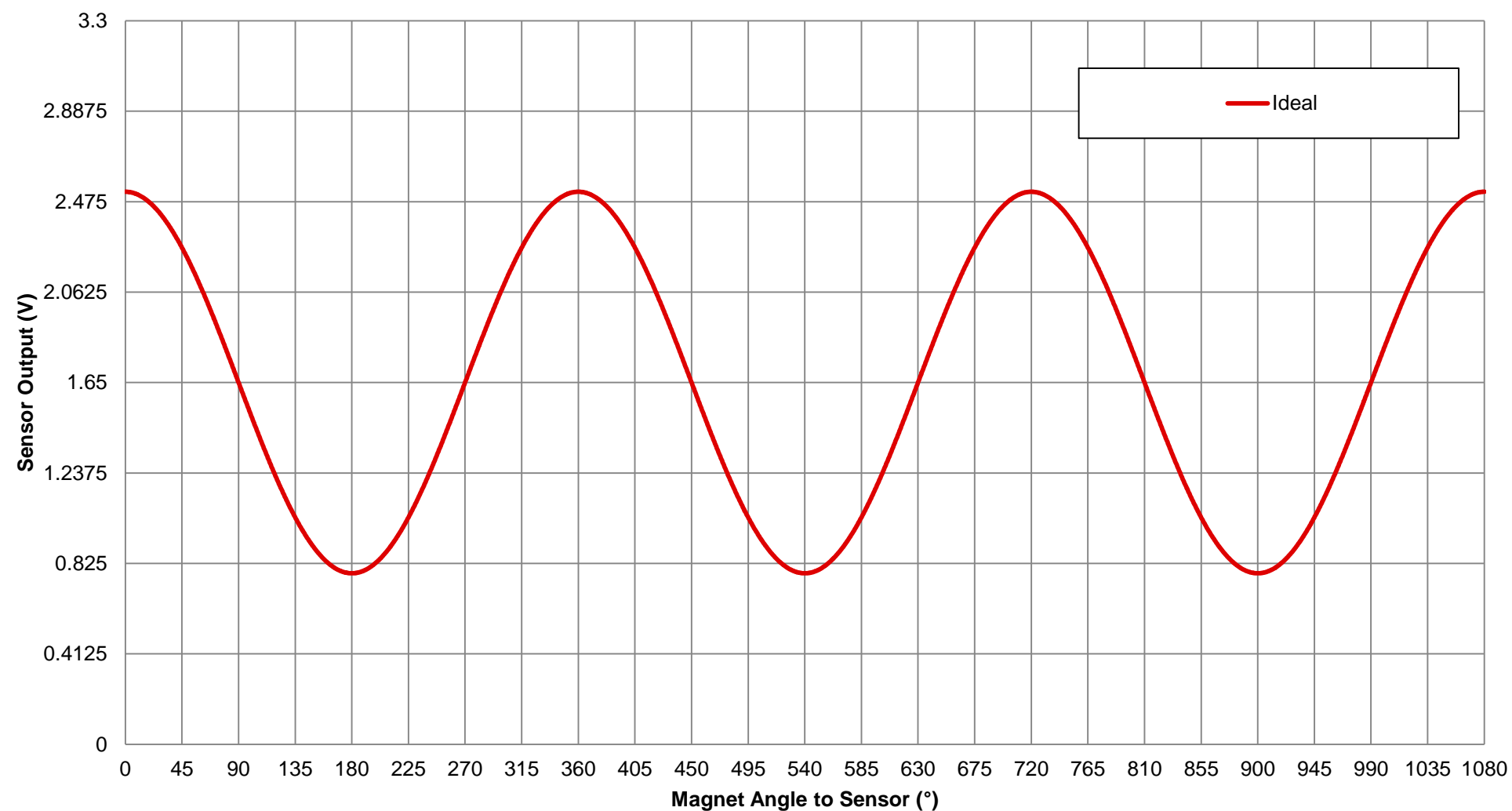


- Rotating magnets
- Angle measurements

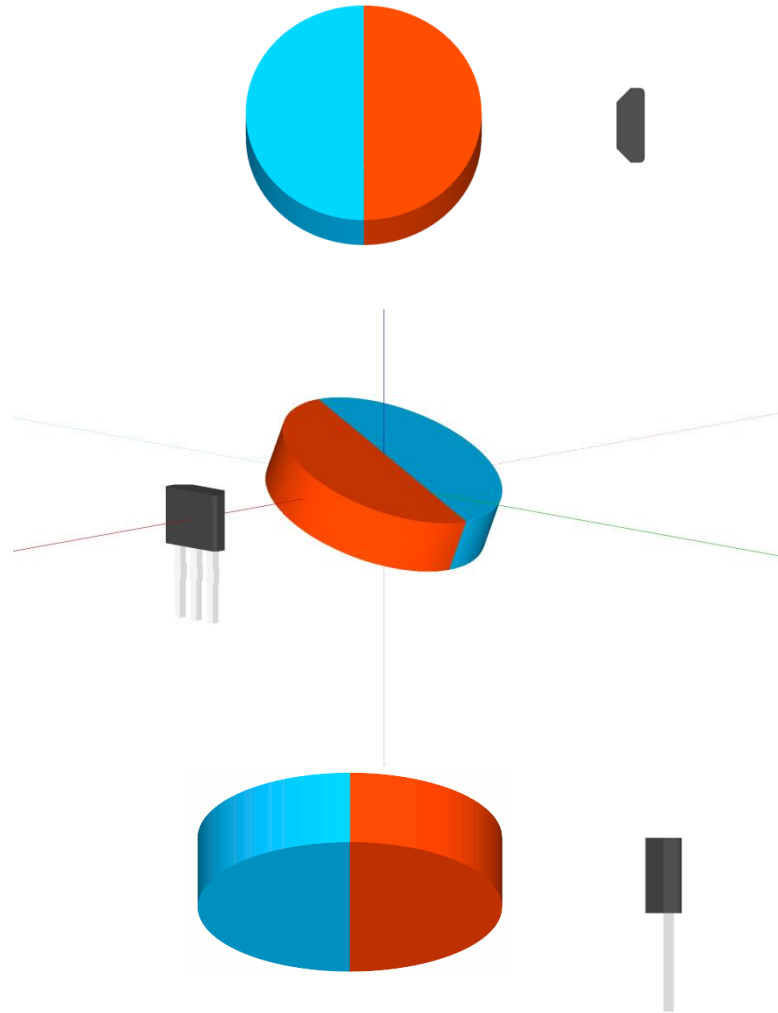
Ideal diametric disc magnetic field



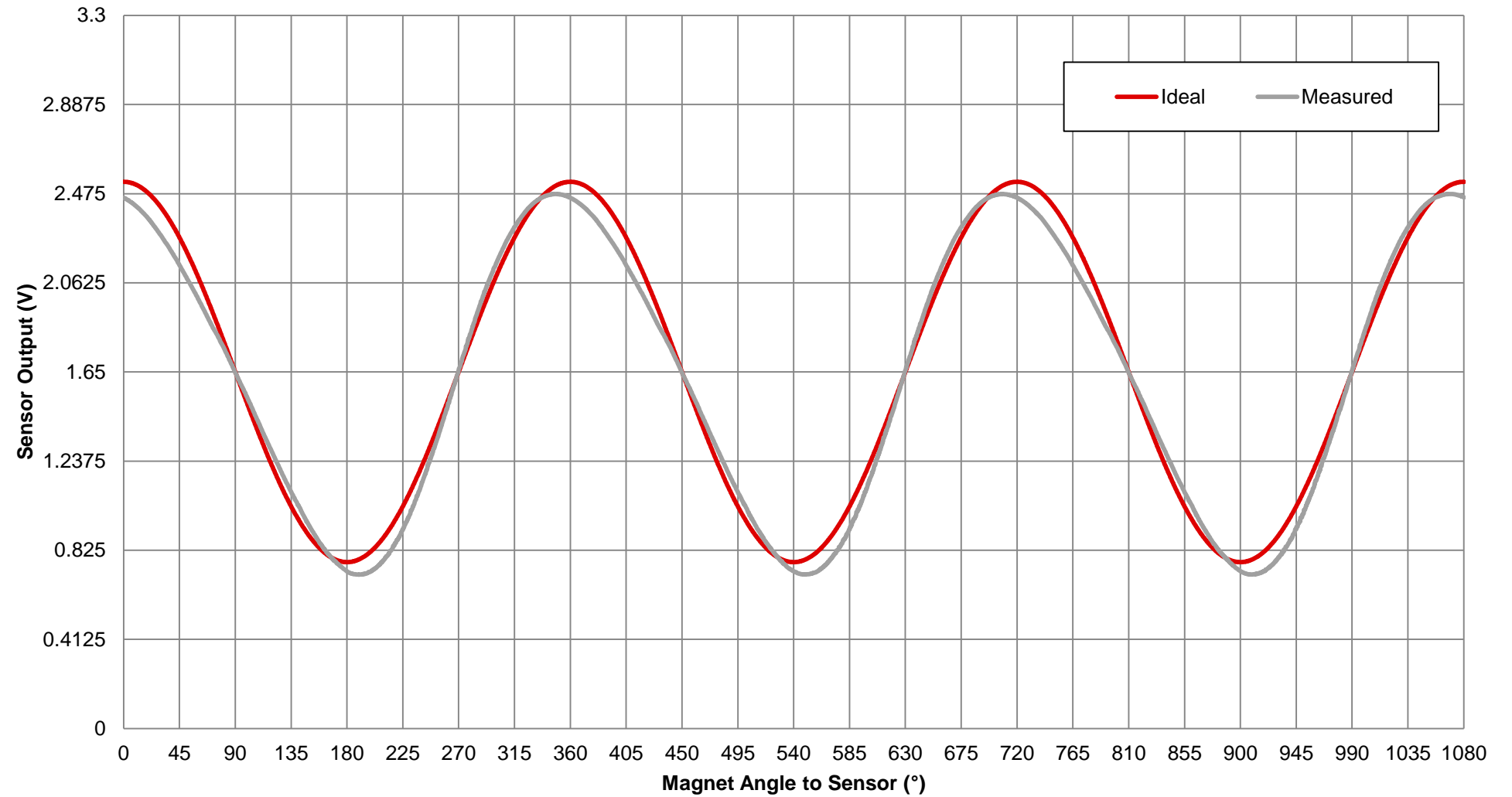
Ideal Wave Data



Tilt magnet

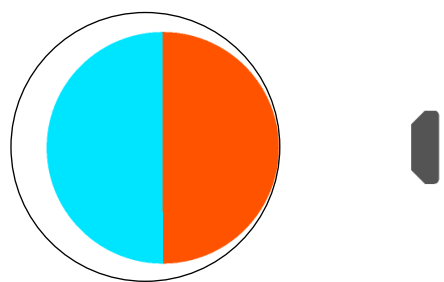


Tilt Data



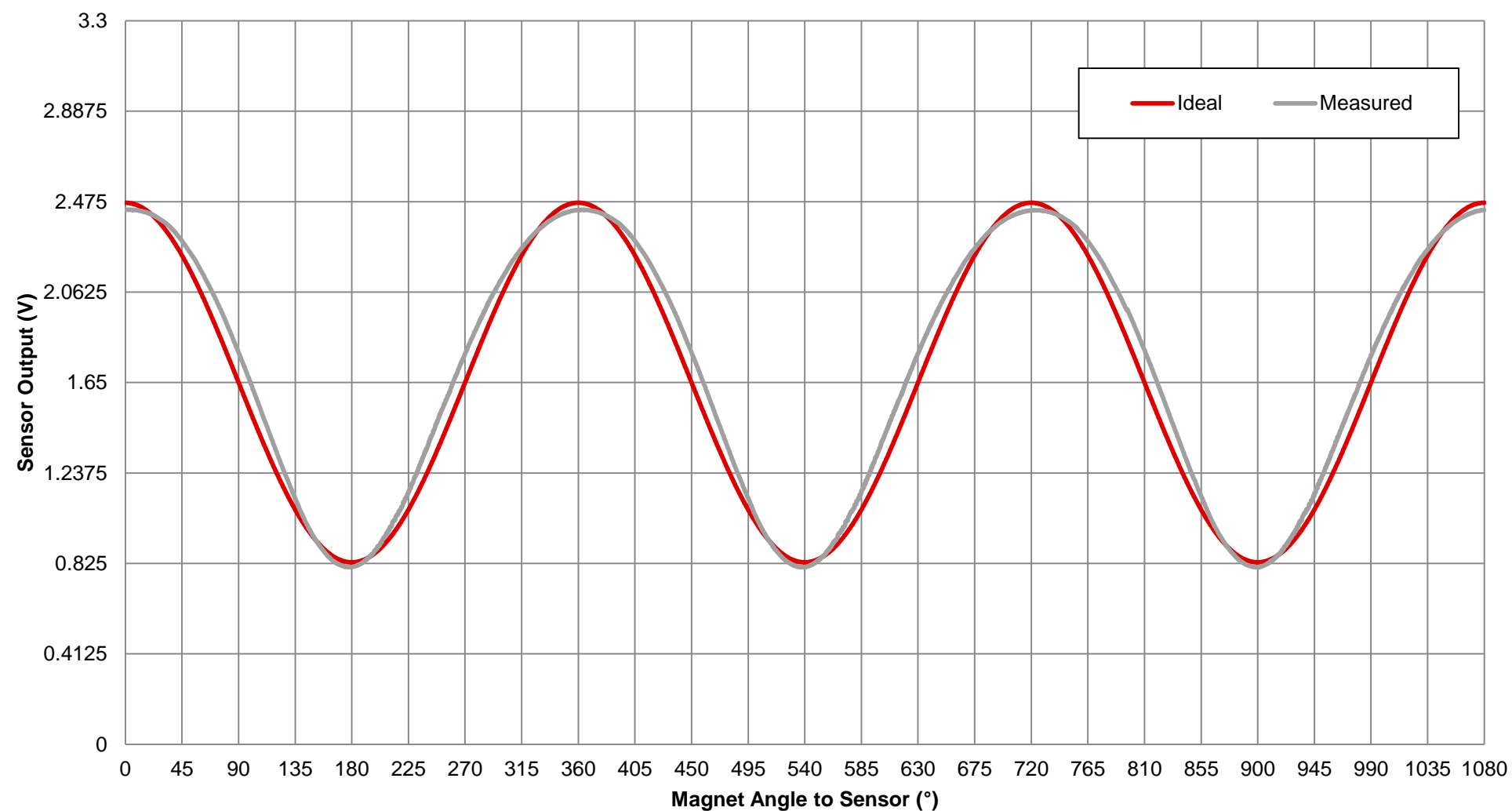
The tilted magnet skews the sinusoidal output of the sensor.

Slightly off-center magnet

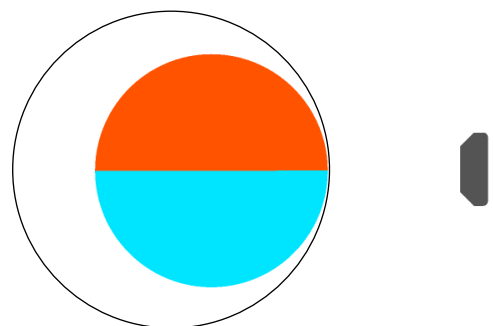


The magnet wobbles while rotating due to an off center axis of rotation.

Offset Data

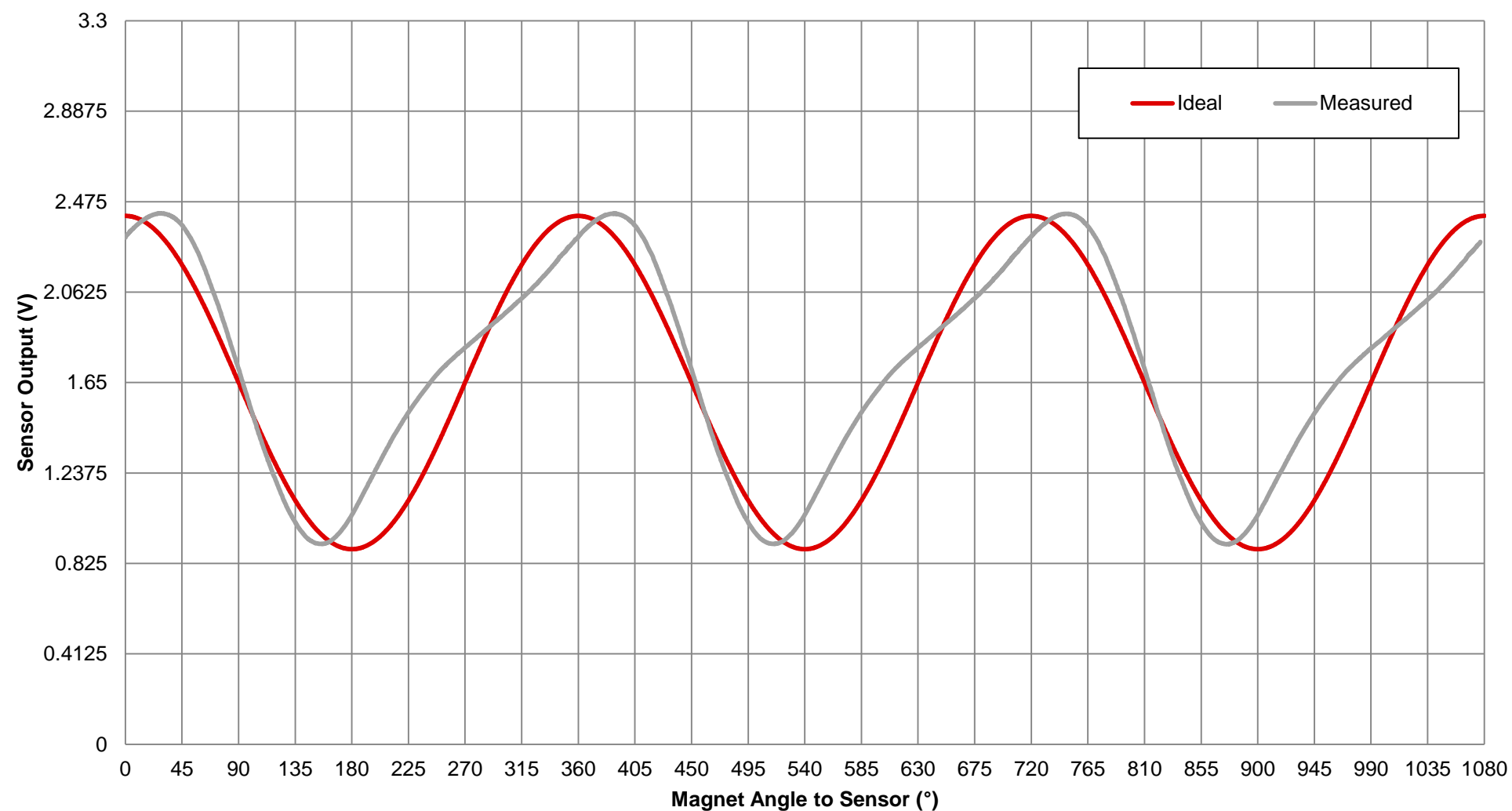


Significantly off-center magnet



Both the significance of the wobble and the orientation of the magnet will affect the magnetic field sensed by the sensor.

Offset Data



Design impact to angle calculation

Calculating angles with ideal Sin/Cos voltage output waveforms:

- Arctan2 (2 sensors)
- Arcsin (1 sensor)

Calculating angles with distorted off-axis voltage output waveforms:

- Majorly distorted waveforms
 - Lookup table calibration
- Minorly distorted signal
 - Arctan2 or arcsin with added calibration

For more information on calibration techniques for measuring angles see TI's application report SLYA036A

<http://www.ti.com/lit/an/slya036a/slya036a.pdf>

To find more magnetic position sensing technical resources and search products, visit ti.com/halleffect