# 3480 Electromagnet


## OVERVIEW

The 3480 dipole electromagnet is a light weight versatile system that can provide fields approaching 4Tesla. At 34kg this magnet can easily be moved between applications and can be operated in any orientation.

The system is intended to be compatible with systems that already utilize GMW's 3470 electromagnet.

The 3480 is shipped with a standard set of poles that optimize maximum field, but several pole options are available. GMW can also design custom poles that achieve a specific performance. Poles are interchangeable and are available with an axial access bore.

## Features

- Weight: 34kg
- Peak fields to 3.6 T
  (5mm pole face diameter at 2mm gap)
- Any Mounting Orientation
- Fast Cycle Times

## Applications

- Hall Effect Studies
- Magneto-Optical Studies
- Laboratory Experiments
- Magnetic Separation Experiments
- Magnetic Alignment of Small Components
- Chemical Reaction Rate Studies

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# Model 3480 General Specifications

**Mechanical**

| | |
|---|---|
| Dimensions | 285mm W x 197mm Dx 213mm H |
| Weight (excluding hoses and water) | 34kg |
| Standard Pole Face Diameter | 5mm, 16mm, 20mm, 40mm |
| Pole Gap | 0 to 75mm |
| Coil Spacing | 47 to 75mm |

**Coils (series connected)**

| | |
|---|---|
| Resistance (20°C) | 1.46Ω |
| Max. Resistance | 1.76Ω |
| Low Current Inductance | 0.23H |
| High Current Inductance | 0.13H |
| Anticipated max. Sinusoidal frequency(1T) | 10Hz |
| Max. Continuous Power (water) | 35A, 60V |
| Max. Continuous Power (air) | 7A, 12V |
| Peak Power (Sinusoid) (water) | 50A, 83V |
| Peak Power (Sinusoid) (air) | 10A, 17V |
| Peak Power (Triangle Wave) (water) | 60A, 100V |
| Peak Power (Triangle Wave) (air) | 12A, 20V |
| Water Cooling (supply 18°C) | 4liters/min, 1.0bar (1US GPM, 15psid) |

**Safety**

| | |
|---|---|
| Overtemperature Interlock | Selco 802L-065 thermostat, mounted onto each cooling plate, wired in series. Contacts below 65°C |
| Diameter Sphere Containing 5G-surface ("fringe field") | 1000mm |

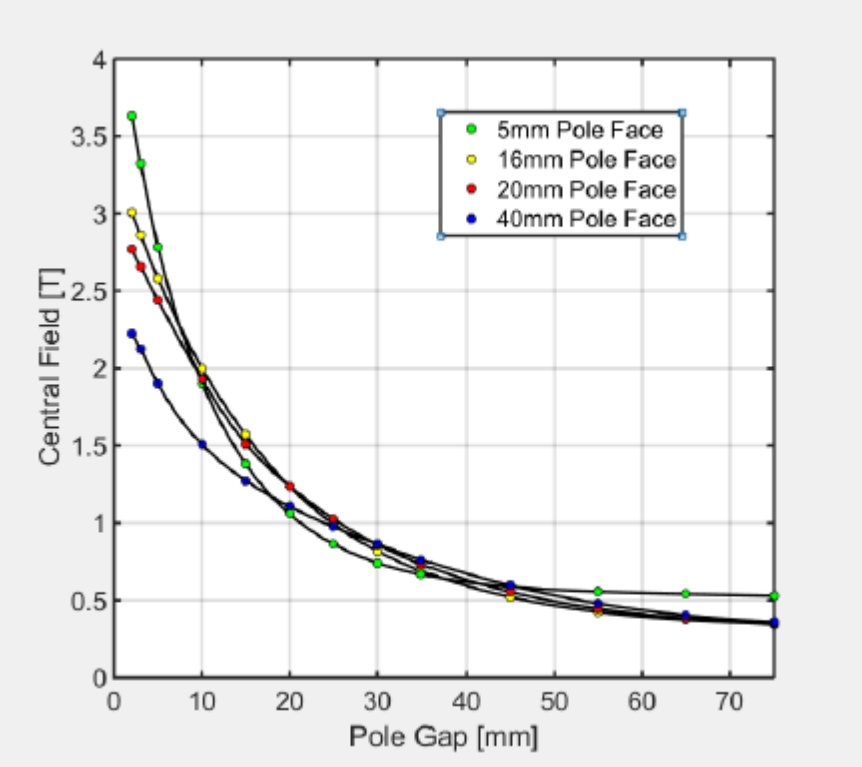
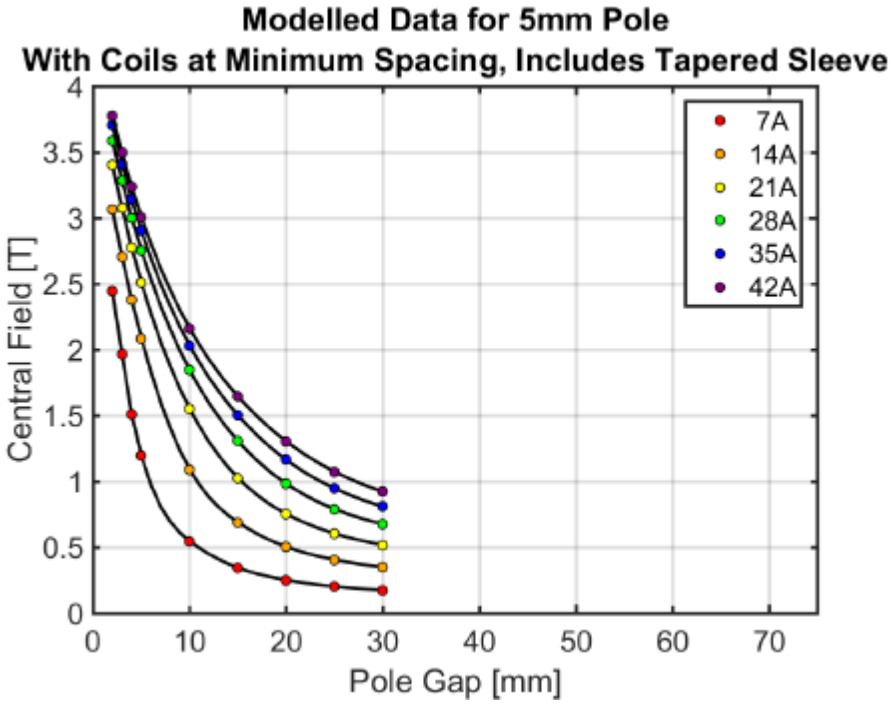
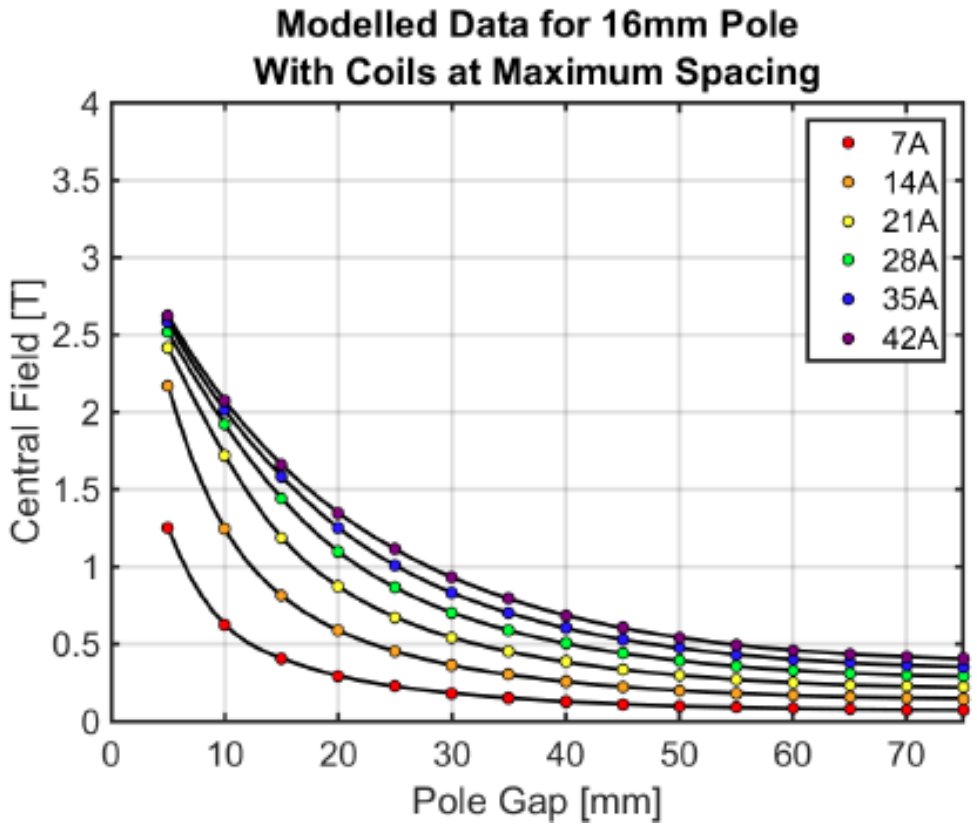
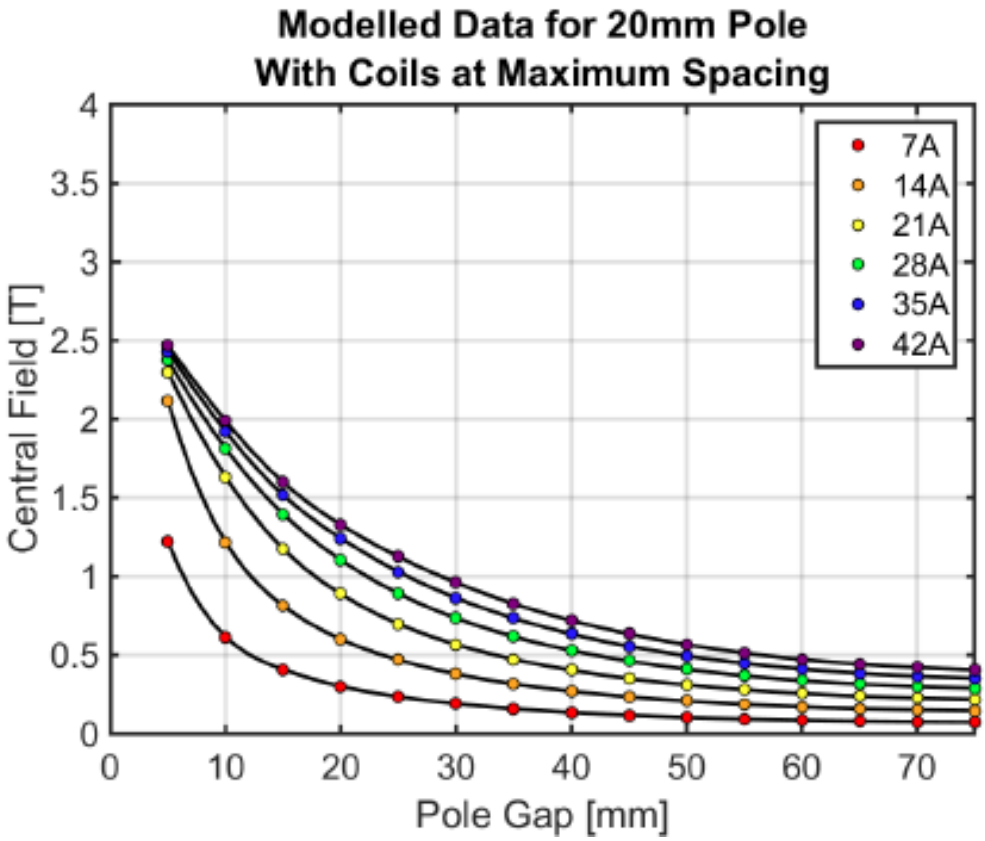
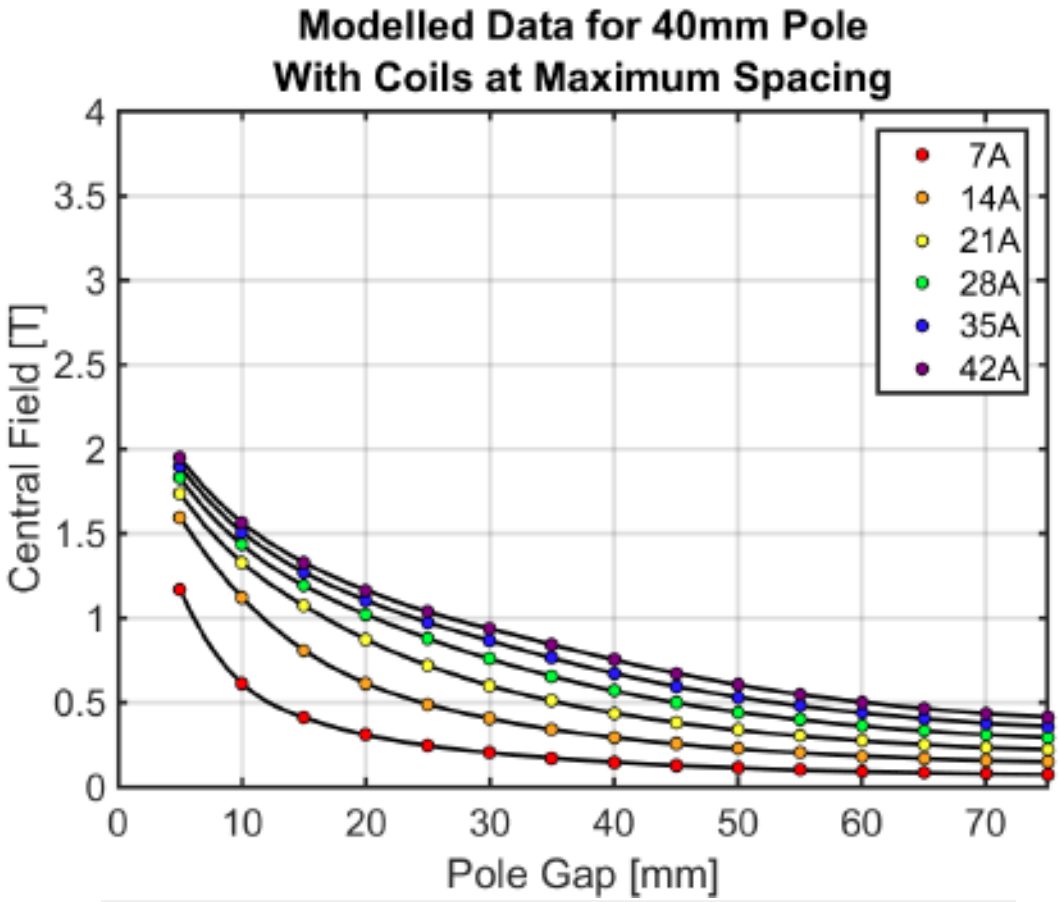



Figure 1: Comparison of performance of different pole pairs. The data reflects performance at 35A with coils at maximum spacing.




Modelled Data for 16mm Pole
With Coils at Maximum Spacing
Central Field [T]
Pole Gap [mm]
7A
14A
21A
28A
35A
42A
0
0.5
1
1.5
2
2.5
3
3.5
4
0
10
20
30
40
50
60
70


Modelled Data for 20mm Pole
With Coils at Maximum Spacing
Central Field [T]
Pole Gap [mm]
7A
14A
21A
28A
35A
42A
0
0.5
1
1.5
2
2.5
3
3.5
4
0
10
20
30
40
50
60
70



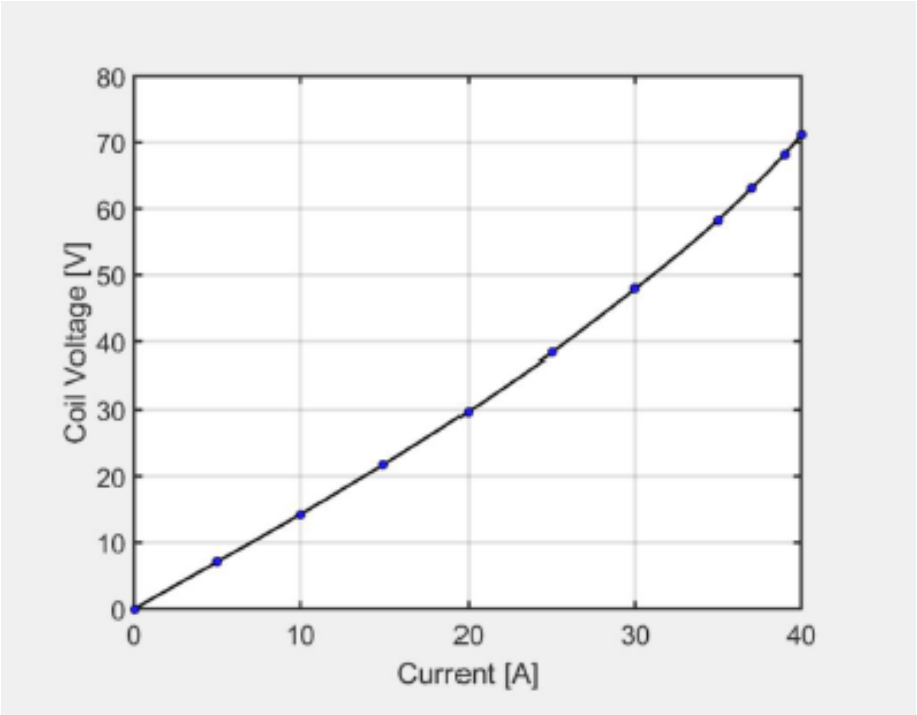




Figure 2: Current versus voltage curve for all windings connected in series. The departure from linearity is due to coil heating.

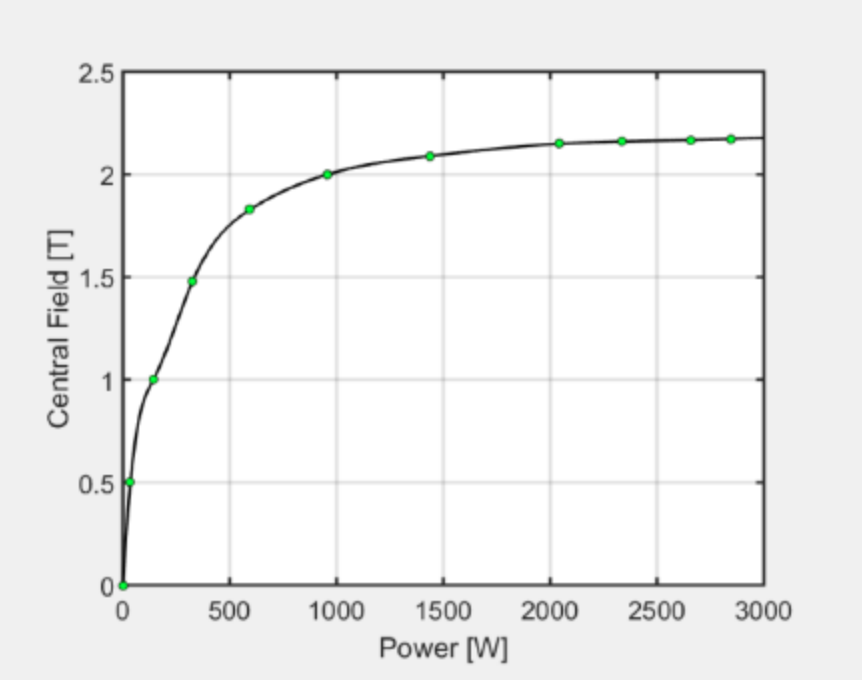
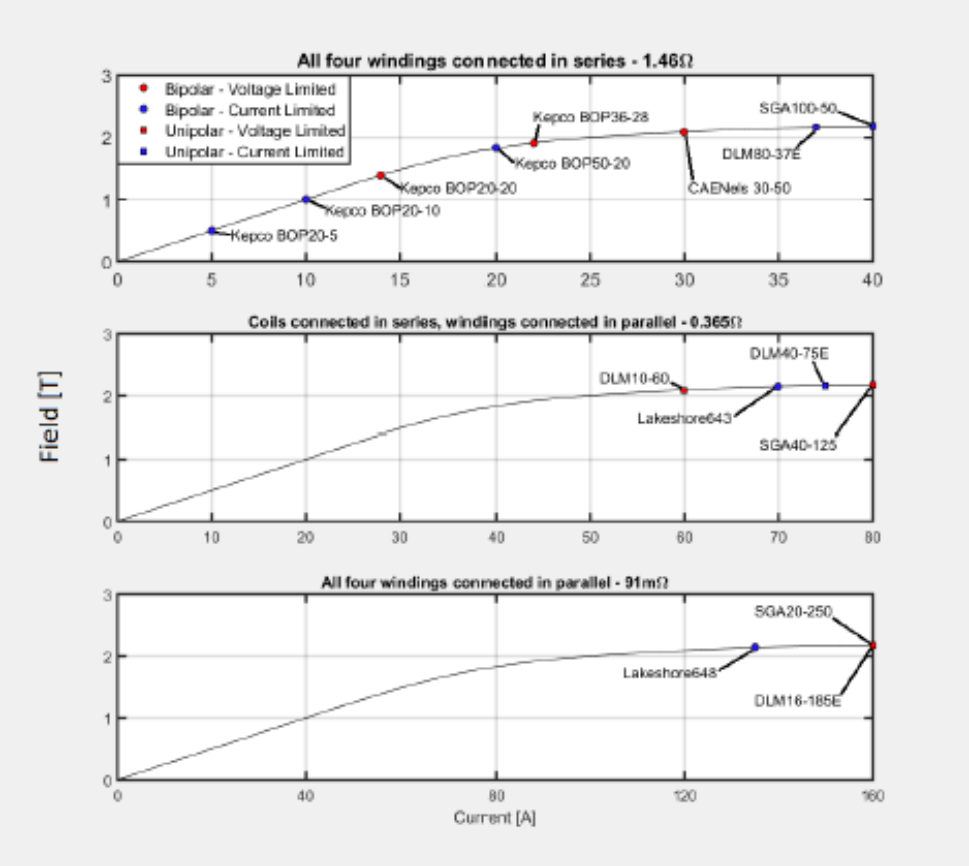



Figure 3: Peak achievable field against available power for standard pole (16mm pole face diameter) at 10mm pole gap and minimum coil spacing. This plot assists the selection of power source for desired performance.



A custom pole is designed to create peak field across a 2mm pole gap for the purposes of FMR analyses. A comparison with the standard 16mm pole is shown below.

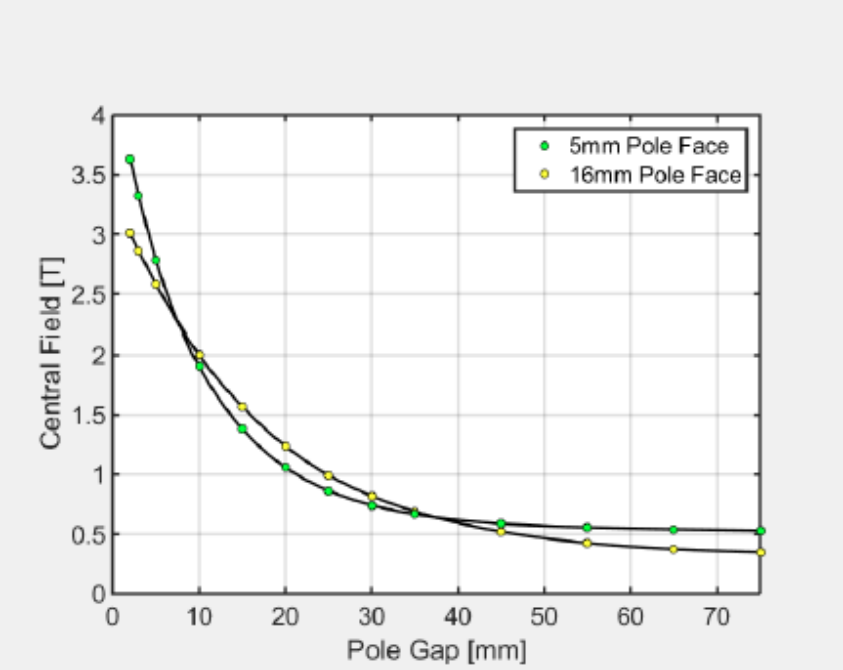



Figure 4: Field versus pole gap for two pole options. Excitation is 35A.

For any pole gap an optimized pole is available, on request, which will provide best performance for any specific pole gap.

Field Uniformity in the Median Plane

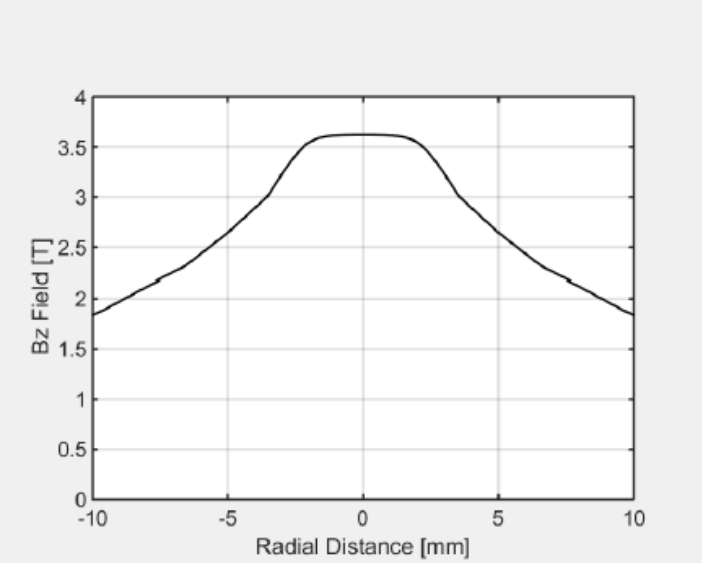



Figure 5: Field profile in the median plane for the 5mm pole face diameter pole. Excitation current is 35A and coils are at minimum spacing. The field uniformity is better than ±0.5% over Ø3mm.

- Peak continuous field 3.71 Tesla
- Peak pulsed field 3.85 Tesla
- Field uniformity <±0.5% over Ø3mm
- Higher uniformity field available on request.

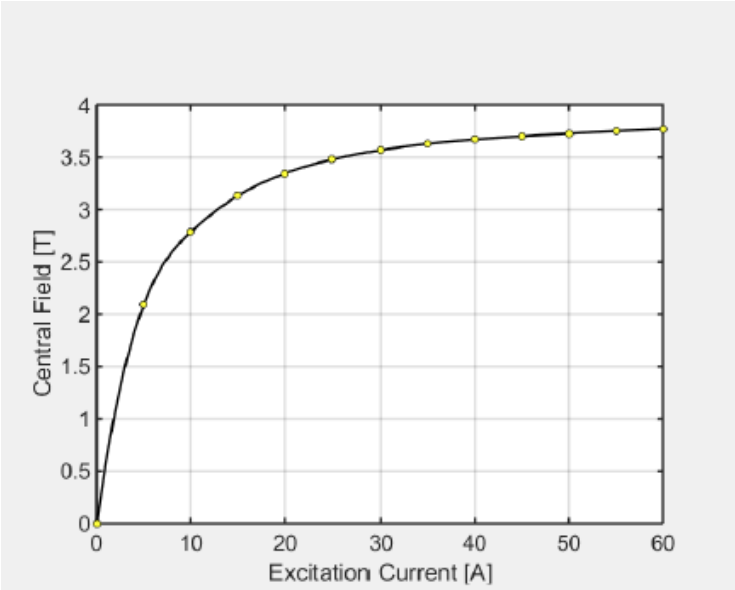



Figure 6: Performance of optimized pole for 2mm pole gap. Continuous operation is possible up to 35A with a triangle waveform possible up to 60A peak.

Application Note: EPR Spectroscopy

GMW offers poles optimized for EPR applications. Two examples are shown below for pole face spacing of 14mm. Each pole give good uniformity across the excitation range for frequencies up to 40GHz but each is optimized to give excellent field uniformity at either K-band or the Q-band. Similar custom poles are available on request for any frequency in the 0-40GHz frequency band.

| Waveband | L | S | C | X | P | K | Q | U | V |
|---|---|---|---|---|---|---|---|---|---|
| λ [mm] | 300 | 100 | 75 | 30 | 20 | 12.5 | 8.5 | 6 | 4.6 |
| f [GHz] | 0.8-1.2 | 3.4-3.8 | 4 | 9-10 | 15 | 24 | 34 | 50 | 65 |
| B [T] | 0.035 | 0.13 | 0.14 | 0.34 | 0.54 | 0.85 | 1.22 | 1.8 | 2.3 |