

DESCRIPTION

The SENIS Model HHROT-1 Helmholtz Coils is a single axis coil pair arranged in Helmholtz geometry to give a relatively large volume of high uniformity magnetic field. The HHROT-1 Helmholtz Coils is an air-cooled system with an aperture of inner diameter 176 mm, with an operating range of 1mT to 20 mT rms. The Helmholtz Coils can be mounted in any orientation and with a mass of 32 kg the HHROT-1 can be integrated into experimental or test equipment.

The unique feature of HHROT-1 is that the magnetic sensor can be positioned in any direction within the uniform magnetic field volume. The HHROT-1 utilizes a set of 3 gimbals. A gimbal is a pivoted support that allows the rotation of an object, such as a Hall probe about a single axis. A set of three gimbals, mutually mounted one on the other with orthogonal pivot axes (Cardan suspension) is used to allow an object (a magnetic sensor) mounted on the innermost gimbal to rotate in all three angles (tilt, roll, pitch) independently. Since the Helmholtz Coil configuration is not magnetically shielded, magnetic and electrical conducting materials should be kept at least 1m from the Electromagnet center to avoid excess distortion of the magnetic field within the working volume.

KEY FEATURES

- **Magnetic field up to 20mT**
- **High magnetic field uniformity: better than 4×10^{-4} over a 20mm sphere**
- **Compact, with the weight of 32kg**
- **Dimensions: 199 x 280 x 337 mm**
- **Inner diameter 176mm**
- **Possibility to rotate a magnetic sensor within the Helmholtz coils in all three angles (tilt, roll, pitch)**

TYPICAL APPLICATIONS

- **Materials measurement**
- **Sensor testing and calibration**
- **Sensor angle measurement**
- **Electronic sensitivity**
- **Biological effects**

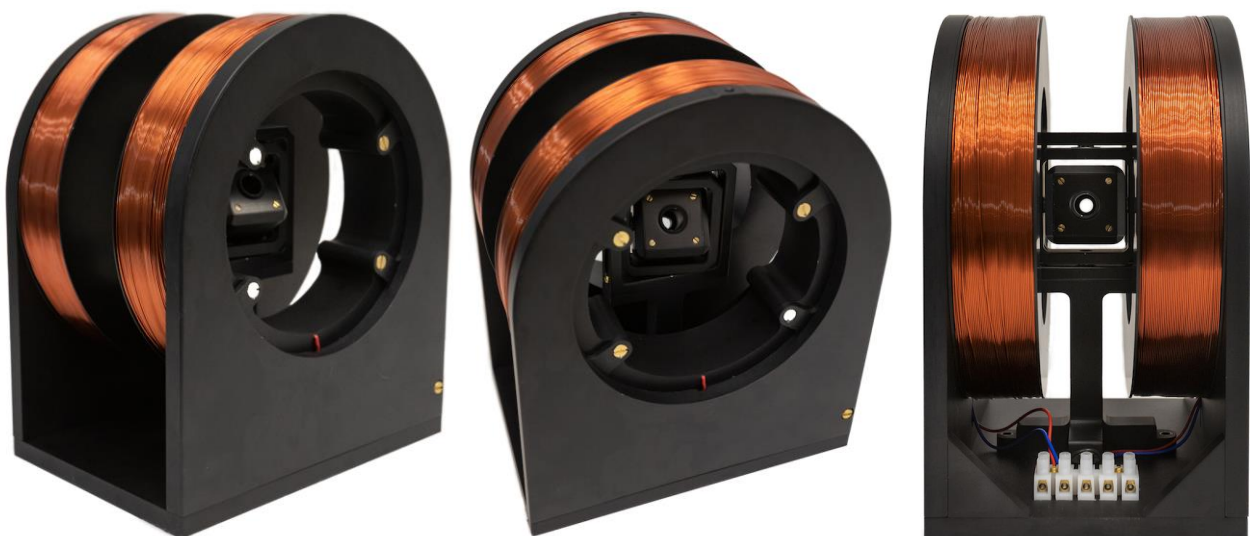


Figure 1: HHROT-1 Helmholtz Coils



MECHANICAL SPECIFICATIONS

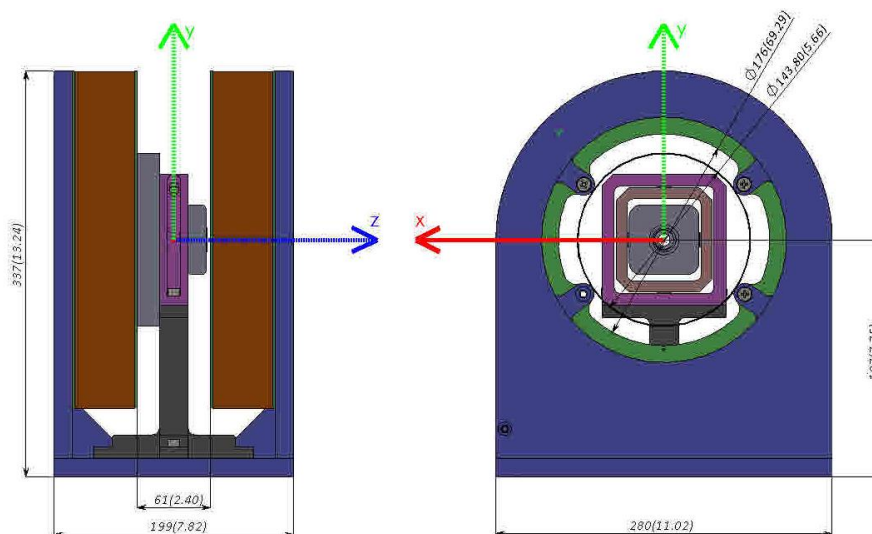


Figure 2: Mechanical dimensions and referent coordinate system of HHROT-1

Mechanical	Value
Inside diameter:	176 mm (143.8 mm without any obstacles)
Overall:	199 mm x 280 mm x 337 mm
Weight	32 kg
Cooling system	Air cooled

MAGNETIC AND ELECTRICAL SPECIFICATION

Unless otherwise noted, the specifications summarized in the table are done at the room temperature (23°C).

Magnetic	Value
Magnetic field range	1mT - 20mT; Short time 50mT
Maximal current (for 20mT)	1.4A
Helmholtz Coil constant $k = B/I$ [mT/ A]	14,353 mT/A
Non-linearity error in the applicable range (After 30 minutes of operation)	better than $4 \cdot 10^{-5}$
$\Delta H/H$ in 20mm sphere	$< 4 \cdot 10^{-4}$
$\Delta H/H$ in 2mm sphere	$< 4 \cdot 10^{-5}$
Electrical	Value
Resistance (series connected coils)	63 Ω
Number of turns	2 x 2200
Wire diameter	$\varnothing 1\text{mm}$
Max power	125W



TYPICAL APPLICATIONS

One application of the HHROT-1 is shown in Figure 3. The magnetic sensor is fixed to the center point of a set of three gimbals. The innermost gimbal is connected to a 6D laser tracker probe, with a magnetic sensor mounted on it. In this way, the precise optical measurement of all three angles of the magnetic sensor rotation, i.e. the tilt, roll and pitch is performed. By rotating the tracker probe around one central point the influence of the residual magnetic field non-homogeneity is eliminated.

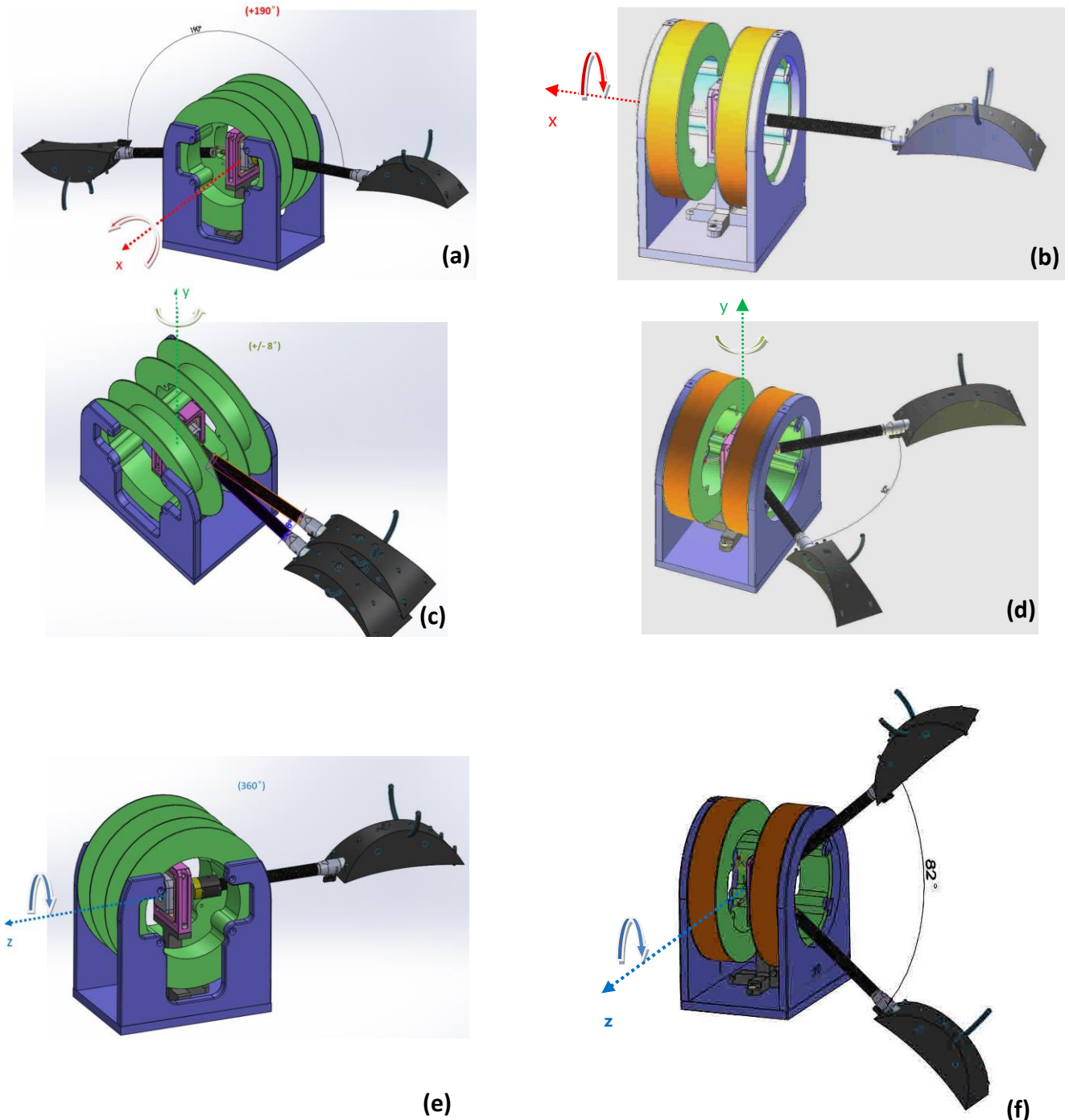


Figure 3: Visualization of the rotation of a magnetic sensor within the HHROT-1
 Rotation around X axis: (a) for access between coils in the range of -20° to $+190^{\circ}$, (b) for access through coils in the range -180° to $+180^{\circ}$.
 Rotation around Y axis: (c) for access between coils in the range -8° to $+8^{\circ}$, (d) for access through coils from -41° to $+41^{\circ}$.
 Rotation around Z axis: (e) for access between coils in the range -180° to $+180^{\circ}$, (f) for access through coils in the range -41° to $+41^{\circ}$.

