

Design and manufacturing of coils for MRI application

NeuroPoly Lab, Polytechnique Montreal



POLYTECHNIQUE
MONTRÉAL

WORLD-CLASS
ENGINEERING



Context

- MRI is a non-invasive medical imaging technology.
- RF coils are necessary to record the signal from the tissue.
- However, product coils do not have enough sensitivity for several research applications (neonatal, animals, advanced quantitative MRI, etc.).
- We propose a service platform for designing and building custom coils.

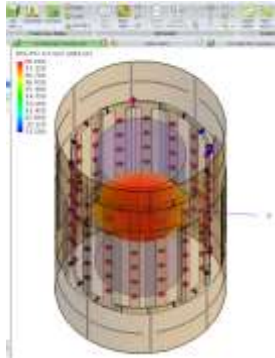


Source: <http://www.sgeu.org/latest-news/media-room/archive/open-letter-in-opposition-to-pay-for-use-mris>

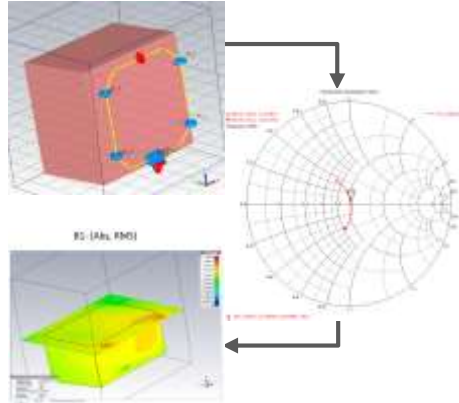
Expertise: Simulation and circuit design

→ 3D Electromagnetic (EM) simulation

FEKO



CST MW Studio

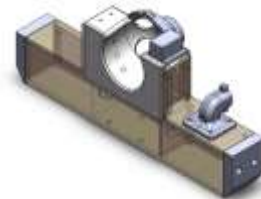


→ Mechanical design

AutoCAD

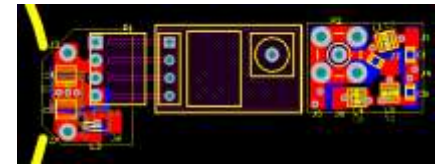


SolidWorks



→ Printed Circuit Board (PCB) design

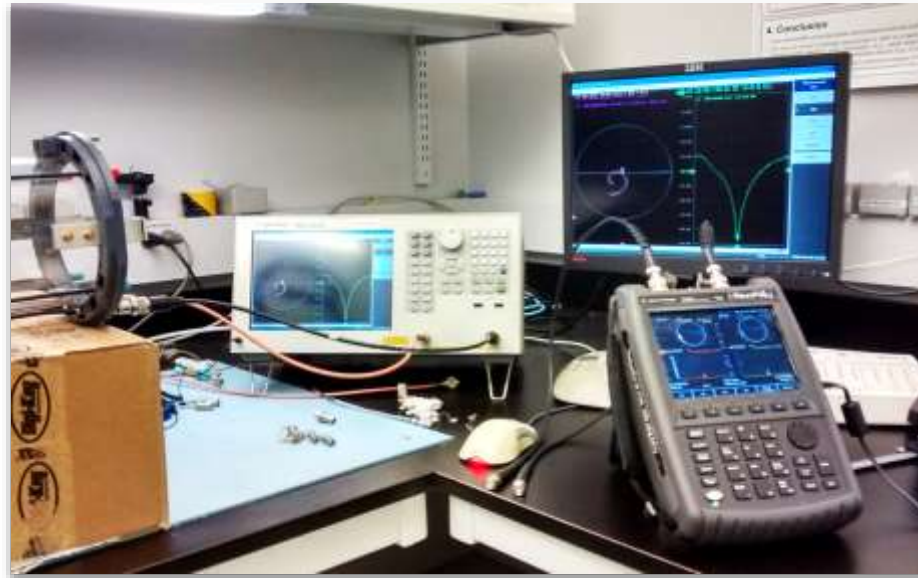
Altium Designer





Facilities: Vector Network Analysis (VNA)

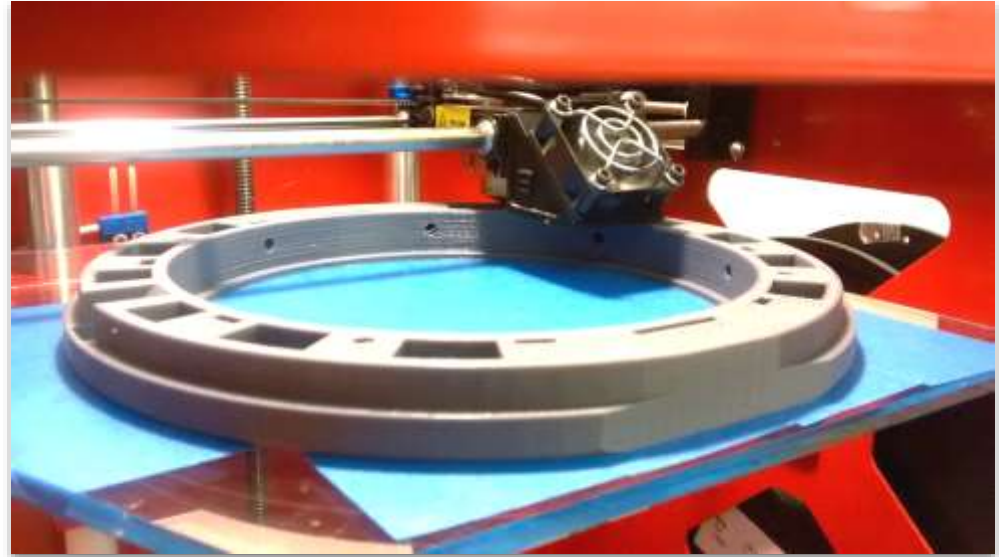
- Agilent E5061B 2-port to measure reflection/transmission with high accuracy.
- Portable “FieldFox”, which can be brought to the MRI environment.



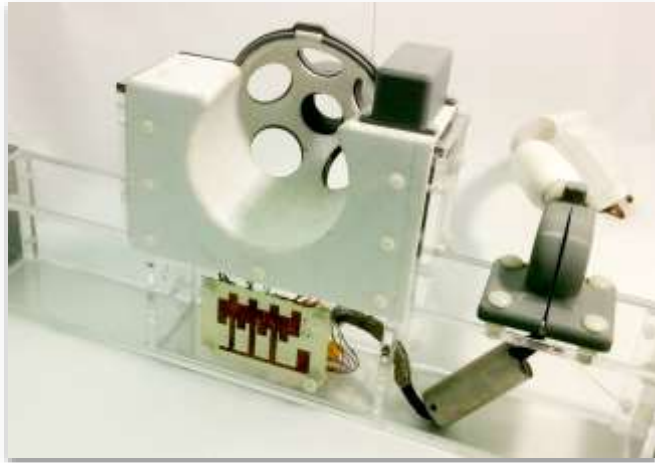


Facilities: 3D printing of large objects

- "Big-Builder": Wide print field (25 × 25 × 60 cm).



Example of projects at 3 tesla (3T)

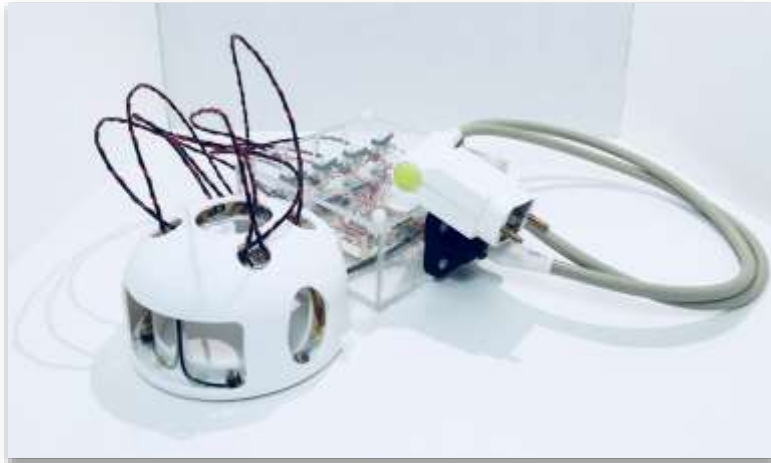


8-channel coil for 3T Siemens
Application: Non-human primate brain
Collaboration: Dr. Shmuel (MNI, McGill)

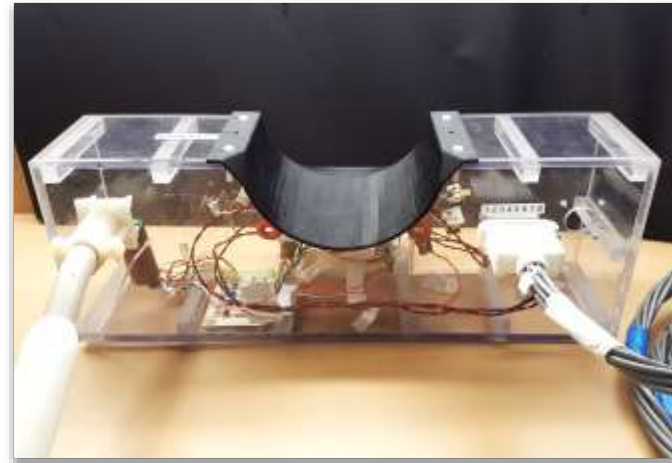


13-channel adjustable coil for 3T GE
Application: Neonatal human brain
Collaboration: Dr. Lodyginsky (Ste-Justine Hospital)

Example of projects at 3 tesla (3T)



8-channel coil for 3T Siemens
Application: Non-human primate brain
Collaboration: Dr. Frey (Rogue Research)



8-channel coil with integrated shimming
Application: Cervical spinal cord
Collaboration: Dr. Wald (Harvard-MGH, USA)

Example of projects at 3 tesla (3T)



8-channel coil for 3T Siemens

Application: Non-human primate brain

Collaboration: Dr. Frey (Rogue Research)

Example of projects at 7 tesla (7T)



Transmit/Receive “solenoid” coils for 7T
Application: Ex vivo tissue
Collaboration: Dr. Stikov (Polytechnique)



Transmit/Receive “birdcage” coil for 7T Agilent
Application: Rabbit heart
Collaboration: Dr. Lesage (Montreal Heart Institute)