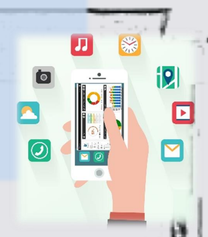
Future Superconducting Magnet Technology

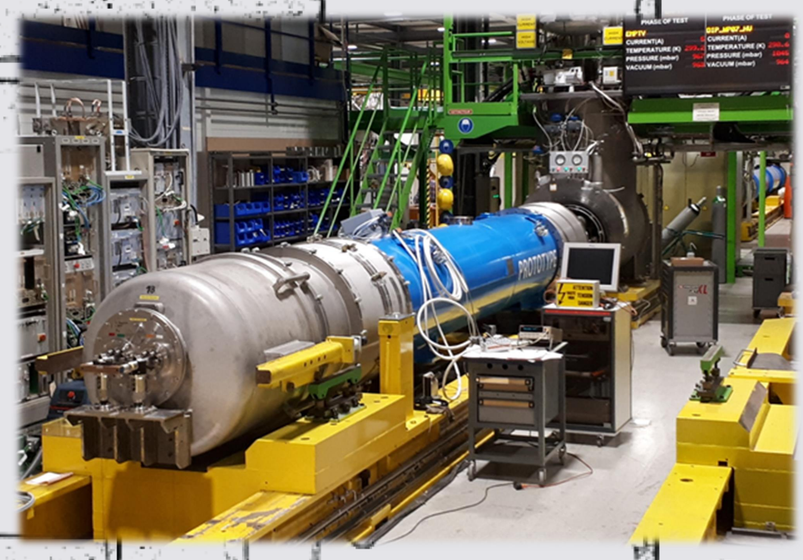
FuSuMaTech

T4.3 Smart Wireless Diagnostics.

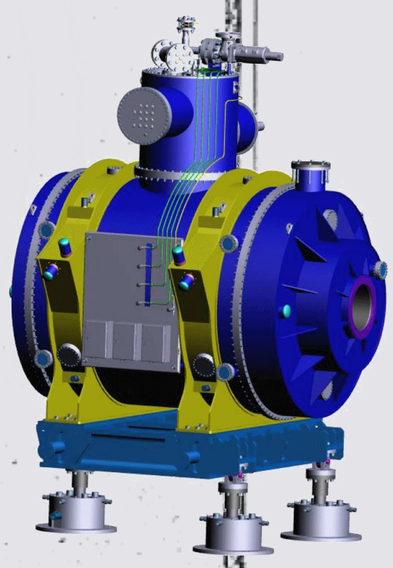
What if …



we treat a superconducting magnet as an IoT device.

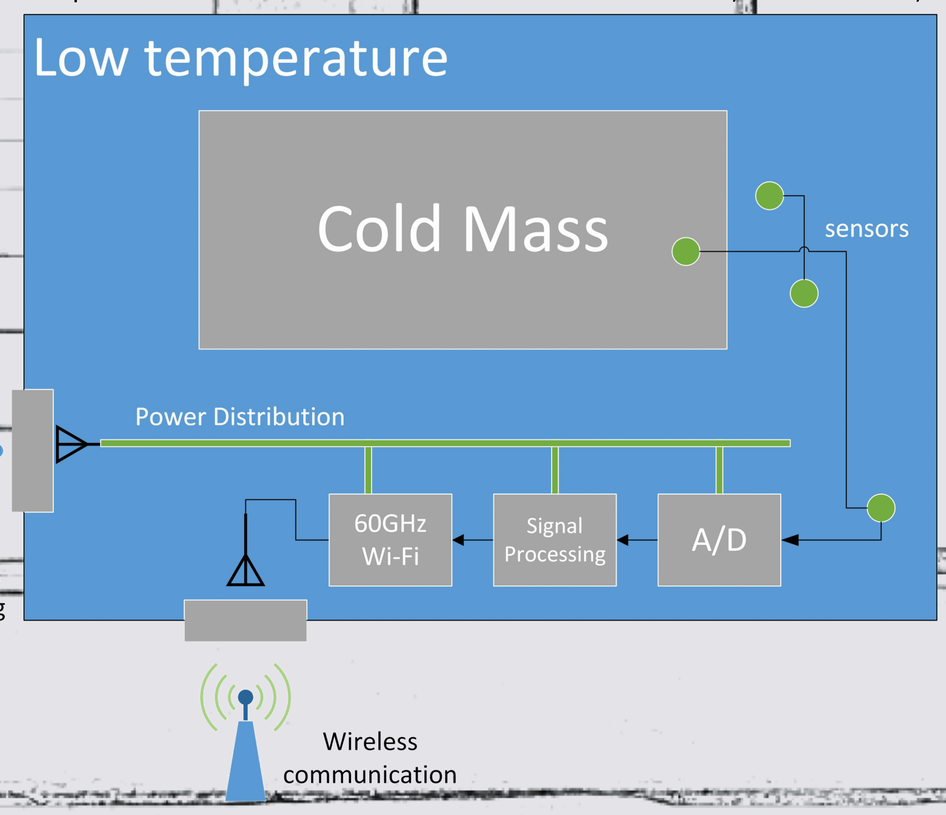


CERN LHC Dipole



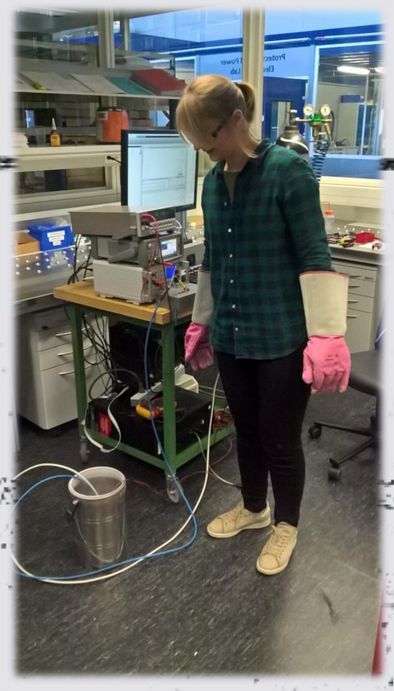
Medical MRI

low temperature : in the order of the thermal shield levels, 50 K to 70 K, or below



What if …

we confine the embedded electronics and sensors for the instrumentation inside the cryogenic vessel with wireless transmission for data and power.

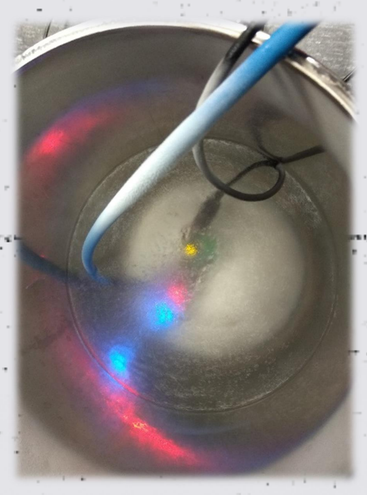


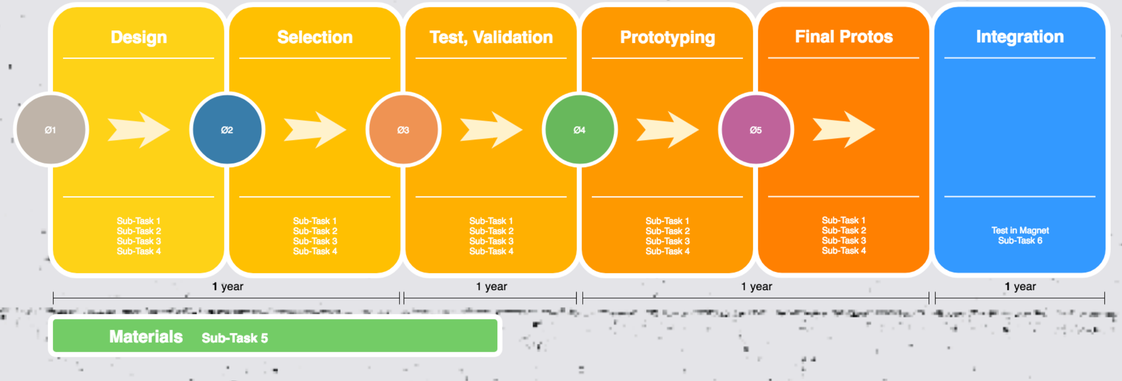
The main challenges in front of us are:

- to develop a working electronic data acquisition system of high precision at low temperature
- to develop a working wireless electronic communication link at low temperature
- to develop a working wireless powering system at low temperature
- to develop a radio frequency transparent material to build a “window” or an antenna, at the wall of the cryogenic vessel, for the wireless communication link and for the wireless powering system
- to develop materials and assembly technologies to build flexible PCBs (printed circuit boards) for the confined electronics at low temperature

The main objectives are:

- to confine the electronics for monitoring, diagnostics, control and protection functionalities inside the superconducting magnet. This reduces the complexity of mechanical and thermal design eliminating the need of inserts for the instrumentation
- to have more and different types of sensors that are better and faster in collecting abundant high precision real-time data
- to “virtualise” the highly complex instrumentation and profit from the new Big Data technologies and Artificial Intelligence, This will reduce significantly the required time to gain “expert experience” from the superconducting magnets and will allow us to understand and solve the problems we are facing at the technology edge of superconductors
- to access a superconducting magnet efficiently and conveniently from remote devices (like smart phones, tablets or intelligent screens)





	Sub-Task 1 sensors	Sub-Task 2 acq. and control	Sub-Task 3 wireless comm	Sub-Task 4 wireless power	Sub-Task 5 materials	Sub-Task 6 integration	
Duration	3 years	3 years	3 years	3 years	1.5 years	1 year	
Material	100K€	200K€	150K€	150K€	80K€	100K€	
Manpower	150K€/year	250K€/year	180K€/year	180K/year	180K€/year	150K€/year	
Use of installations	80K/year	80K€/year	80K€/year	80K€/year	80K€/year	80K€/year	
Total	790K€	1190K€	930K€	930K€	470K€	330K€	4640K€

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