

# Magnetic Field Shielding and Generation Strategy

Kill Environmental Background, Make Homogenous Field, Monitor this field well

## Active magnetic shielding

- Noise canceling magnetic “headphones”

## Passive magnetic shielding

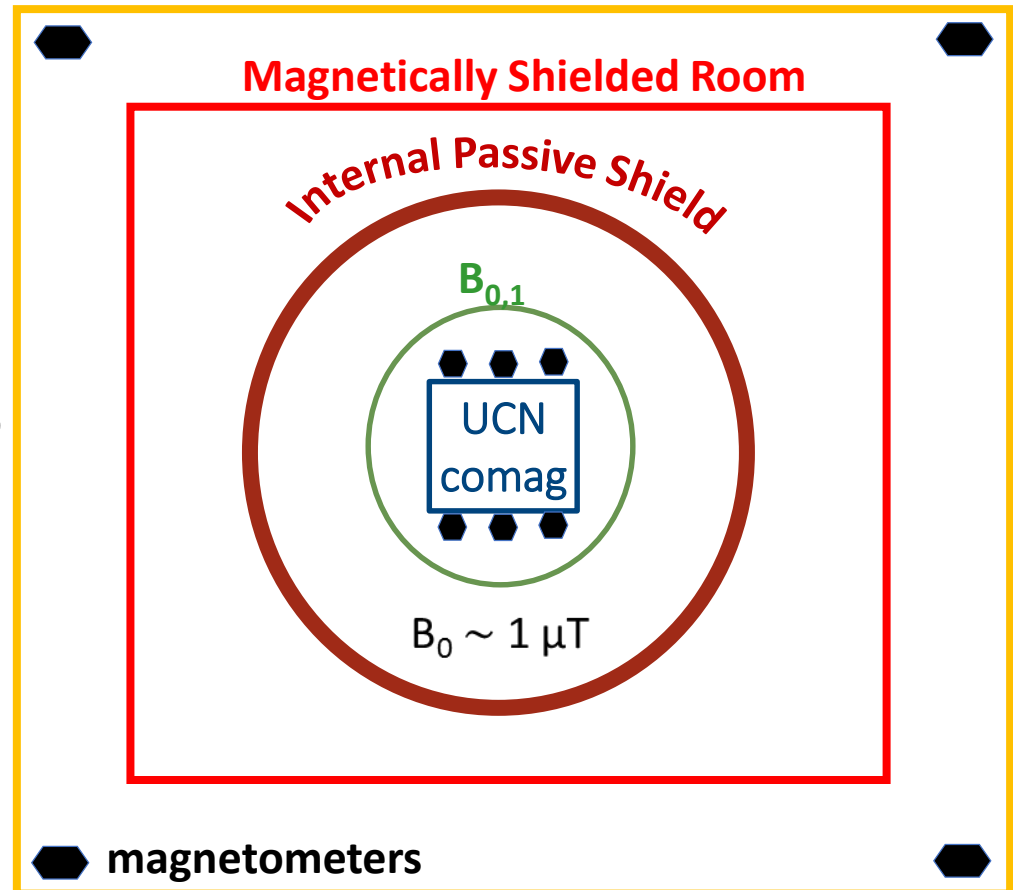
- Analytical Shielding Calcs  
AIP Advances 4, 047135 (2014)
- Stability of  $\mu$  of MuMetal vs temp  
NIMA 867 (2017) 139-147

## Magnetic field generation

- Self-shielded Coils

## Magnetometers

- Xe/Hg co-magnetometer
- **Optical precision magnetometers**  
NIMA 778 (2015) 61–66.



### Active shield

U Winnipeg Professors working on Magnetics:  
Jeff Martin, Chris Bidinosti, and Russ Mammei

# Passive shields at UWinnipeg

## The “Big One”

R1 = 18.5 cm, L1 = 37 cm

R4 = 38 cm, L4 = 90 cm



Used to stability of  $\mu$  of MuMetal vs temp  
And develop Active compensation  
hardware/software

## The “Baby”

R1 = 5 cm, L1 = 20 cm

R4 = 15 cm, L4 = 38 cm



Used for Precision Magnetometer  
(NMOR mostly) and degaussing  
hardware/software development

# Status of the TRIUMF MSR

## 4 Layers MSR provided by Imedco with idealization coils:

Outside Dimension: 2.6 m X 2.6 m X 2.6 m, Inside Dimension: 1.8 m X 1.8 m X 1.8 m,

SF: 70k at 0.01 Hz with background field of 50  $\mu$ T

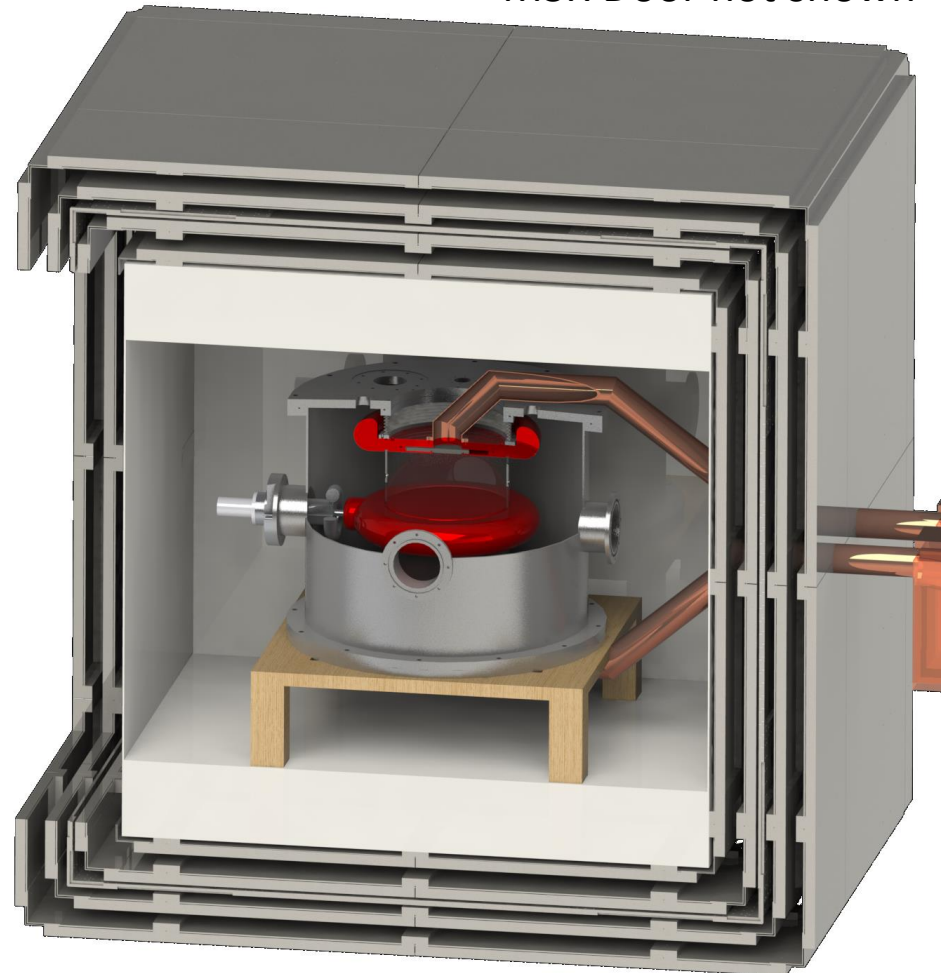
Gradients in 50 cm box at center: 300 pT/m (can expect  $\sim$ 50 pT/m)

Total Cost: 3.28 M (including inkind)

MSR Door not shown

Magnifer mumetal Layer  
thickness (inner to outer):  
2 mm, 6 mm, 4 mm, 4 mm

We have keep out zones from Imedco



# Requirements Questions:

Hole positions and diameters for Guides and cables

What is the largest diameter hole we want and how does it change the B field

**Magnetics Working Group: Opera Simulation with two large guide holes+ various small ones**

MSR Door B leakage specifications:

**Magnetics Working Group:**

Equilibration Procedure and Hardware:

---Need to ensure saturation (with holes and mu material overlaps), now what is the SF

**Opera Simulation to ensure saturation**

Background Environmental B and dB/dz,...

Imedco says 50uT (earth's field), Munich MSR kept it around ~5uT

What is best for us?

Revisit?:

Inside Volume, size enough

MSR + door fits into UCN area at TRIUMF

Is 4 layers enough?