Summary from Magnetic shielding session

S. Chandrasekaran & M. Masuzawa

(1) Measurement of magnetic shielding performance and permeability of soft magnetic alloys for SRF

Mitsuru Sakakibara (Ohtama Co., LTD)

(2) Small magnetic field measurements and control at CERN

Marco Buzio (CERN)

(3) Magnetic field management in cryomodules and vertical cryostats at CEA-Saclay

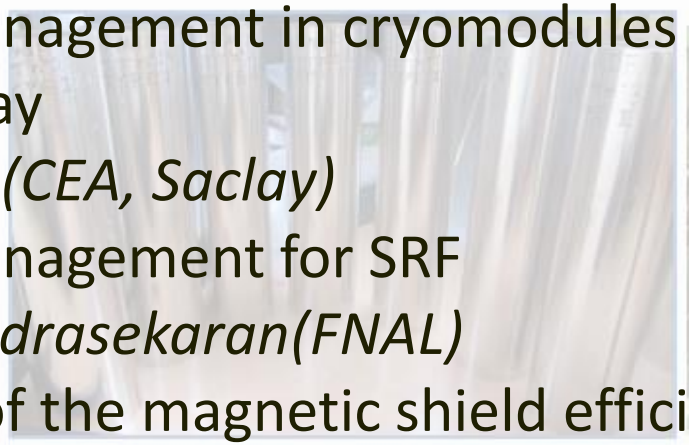
Juliette Plouin(CEA, Saclay)

(4) Magnetic field management for SRF

Saravan Chandrasekaran(FNAL)

(5) Characterization of the magnetic shield efficiency for the ESS double spoke cavities

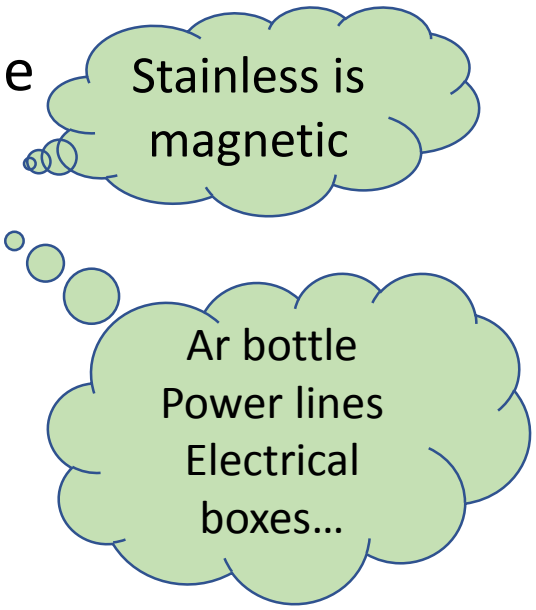
Vateanui Sansine(IPN, Orsay)



What we learned/got reminded of/understood

Understand the environment

- Ambient magnetic field comes not only from the Earth but also from anything magnetic ($\mu_r > 1$) around you.
- And it needs to be shielded down to a certain level(usually a few hundred nT) (Marco, Juliette,Saravan,,,)



Attention should be paid to

- Material
  - Just buying (more expensive) Cryophy/Cryoperm does not automatically guarantee you the performance
  - For example, pay attention to the annealing temperature (Sakakibara: from manufacturer's point of view
- Heat treatment
  - Higher temp is better though deformation may occur (package deal)
- Design

What we learned/got reminded of/understood

Cost

- Cryophy/Cryoperm (material for cryogenic use, by Aperam/Vacuumschmelze) seems like everyone's favorite
  - No degradation at cryogenic temperature (Vateanui)
  - But it is more expensive than permalloy/mumetal
  - FRIB chose permalloy, after various study and obtained good results (Saravan, Kenji)

Active shield and demagnitization

- Worked well for LCLS-II

(Saravan)

Realizing very low ambient field is certainly nice
but cost reduction is also very important especially for large scale production.

What we learned/got reminded of/understood

Evaluation (field measurement)

Sensor : Fluxgate is most commonly used for low field measurements

- “Absolute” calibration is hard (Marco) though good for relative measurements, stable (Vateanui et al.)
- Sensor volume large
- Not cheap
- Other sensors (not my session but see Julia’s talk)

Needs more work on

- Evaluation of the effects of the (not non-magnetic) elements used around the cavity is needed.
- How to use the B-H data of the sample ?
- Effects of thermal (cool down/warm up) cycle?
- Absolute calibration of the sensor
- Improvements of the shielding performance by increasing the annealing temperature.
- Welding matters (our experience, also Saravan's) or does not matter (Juliette talk)? Type of welding?
- De/Re-magtization can happen.
- More thorough mapping of the magnetic field (smaller/cheaper sensors?) is helpful for observing flux expulsion, for example.
- System integration
  - Integrating the magnetic shield and cavity system without having them interfering (physically & magnetically) with each other is important.