

# Magnets Working Group Meeting Notes

<https://indico.cern.ch/event/1240046/>

Magnet Working Group

Thursday 11 May 2023

## News

- See HTS technical specs for 1 km of REBCO coated conductor:  
<https://indico.cern.ch/event/1240046/contributions/5356502/attachments/2645865/4579815/HTS%20techspecs%20v3.pdf>

## Presentations

### Neutrino Flux Basics and RP Considerations, C. Ahdida et. al.

#### *Some key notes*

- Two main RP challenges for muon collider:
  - Conventional radiation throughout complex: prompt and residual radiation, air and Hr activation, water and soil activation, radioactive waste
  - Neutrino radiation from collider ring at Earth's surface
- ....
- When is a material radioactive? Specific and total activity exceed limits (LL values) as given in the Annex of EDMS 942170 (from swiss legislation)
- Radioactive waste zoning according to the LL criterion: if  $> 1$ , considered radioactive.
- Soil activation
  - Requires activation studies in combination with a dedicated hydrogeological study
  - Long-lived radionuclides H-3 and Na-22 are both soluble radionuclide can be transported by groundwater -> focus soil activation constraints on these.
  - Soil activation around collider arcs expected to be acceptable with adequate collider placement
- Summary of arc dipoles study
  - Non-negligible neutron flux
  - Residual radiation levels in arc dipoles region similar to HL-LHC inner triplets region
  - Radioactive soil thickness around tunnel similar to HL-LHC
- A refined dose model to estimate neutrino-induced radiation is being developed
  - Extensive FLUKA simulations
  - Assumptions: no magnetic fields between magnets, eff. Dose for 1 ye (5000 h, 5 Hz) operation at 100 km distance
  - Observations
    - Spikes from short (0.3m) straight sections
    - Divergence from beam reduces height of peak
    - Mitigation measures needed
- Mitigation measures
  - Optimize collider placement: go deep underground; high neutrino flux areas go into uncritical areas owned by lab...
  - Optimize the lattice: machine wobbling.
- See slide 22 for summary of neutrino studies (what has been done and to do)

### *Some questions / comments*

- Luca
  - screen, tungsten shield will be very active... -> remote handling.
  - Concrete layer gets more activated than the rest, magnet highly activated
  -

## **Muon Collider Magnet Moving for Neutrino Mitigation, Francesco Bertinelli et al**

### *Some key notes*

- Mitigate the neutrino flux by machine 'wobbling'
- Assumptions
  - Dipole magnet model based on LHC magnets (L=10m, D=1m, mass = 24.5 T, length of interconnection 500-800 mm, cold bore 50 mm diameter, 3 jack supporting, radiation similar to LHC)
  - Dipole rotation for vertical kick is not longer considered
  - Lateral forces on dipole magnet only from gravity and tunnel angle 1.4%, on quadrupole also from vac varrier and He lines (not studied yet)
  - Commercial jack (precision +/-0.5mm, mech driven, self-locking, lateral forces appr. 3-5%)
- Alignment of magnets
  - Solution 1: alignment jacks HL-LHC jack 2 jacking system.
    - Motorized jacks: vertical movement +/-50mm, magnet tilt, parasitic movements in jacks (<3 micron)
  - Solution 1a: two jacking system
    - Parallel operation of jacks across the interconnections
    - Connect jacks mechanically
    - See slide 7
  - Solution 1b: two jacking system
    - Alignment jacks across the interconnection on common platform
    - One central jack for height change
    - ... see slide 9
  - Solution 2: combined jack
    - Combine the function of 2 jacks – alignment and layout change
- See slides 11-14 for tunnel space, He supply considerations, powering considerations and beam trajectories vs magnet movements.
- Conclusions
  - 2 solutions to move magnets presented
  - Information needed: aperture confirmation; period confirmation

### *Some questions / comments*

- \*This section empty as I had to leave the meeting for IPAC23 lectures.