Cooling Channel Magnet Certification Plan

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Purpose

Guiding Principle:

Errors in field map *must not* contribute significantly to emittance measurement errors.

- **Measured field map will be converted to G4MICE field map for analysis**

Purpose

Characterization of magnets

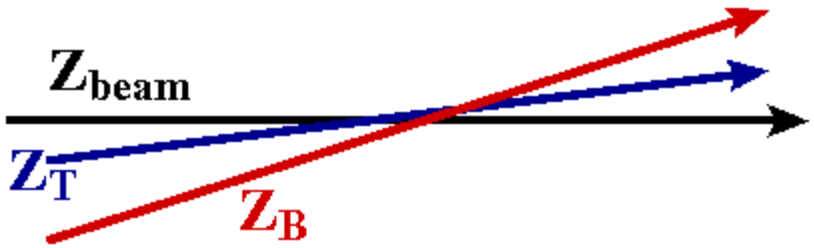
Two Sets of Measurements

- At vendors:
  - Determine magnets operate according to specifications
- In situ in MICE hall
  - real configurations & real environment
  - check field alignment
  - check field uniformity
  - check field consistent with Maxwell
  - fringe fields

Purpose

Additional reasons:

- Determine if simulation matches data
- Fringe fields
  - Force models
  - Nearby equipment (pumps, electronics, …)
  - Global tracking
- Relative and global alignment



- Scale with fixed hall probes

Tasks – before mapping

Software readiness:

- Convert map to G4MICE map
- Tests for map:
  - Superposition
  - Relative alignment of magnetic and geometric axes
  - Field uniformity
  - Field consistency with Maxwell's equations
  - Emittance errors introduced

Tasks – before mapping

What do we need to know?

- How do we quantify field error contributions to emittance?
  - Uniformity, positions, magnitudes
- What can we do analytically?
- What simulations do we need?
- How to convert map to G4MICE map?
  - Introduce conversion errors?
  - What grid step size?

Tasks – at vendors

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At vendors (coarse grid):

- Measure each coil separately
- Measure at 0.25, 0.5, 1.0, 1.1 xI_{max}
- Measure 5 coils (at 0.25, 0.5, 1.0, 1.1 xI_{max})
  - Convert map to G4MICE
  - Checks:
    - Superposition
    - Alignment of magnetic and geometric axes
    - Field uniformity
    - Verify Maxwell's equations

Vendor Mapping Grids

- 10cm longitudinal steps
- 20° angular steps
- SS 5(4) coils at 4 currents + all coils
  - 20 configurations
  - 7 days
- FC coils at 4 currents + two coils
  - 12 configurations
  - 2.5 days
- CC coils at 4 currents
  - 4 configurations
  - 1 day

Vendor Measurements

In all that follows, I propose 2 sets of rails:

- **1 at RAL and 1 to move between vendors**
- ***Vendor measurements are intended to check that magnet operates according to specifications – this is best done when magnets are operated in final configuration with full control system***

Conclusions

- **Measurements differ: (vendor & MICE)**
- **Mapping is necessary to certify magnets**
- **Preliminary task list under way**
- **Must have full control system for vendor measurements**