RFOFO Ring Status in GEANT

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**RFOFO Ring Overview**

- We simulate the RFOFO ring based on ICOOL version 2.40 with useful information from Bob Palmer and Rick Fernow.

- The ring is about 33 m in circumference. It has 12 cells and each cell is 2.75 m long.

- The overall dipole field for bending is 0.125 T.
RFOFO Ring Overview

- 1 cell = half wedge + 6 RFs + half wedge
  The alternating solenoid coils are located outside pillbox RF cavities

- RF freq. = 201.25 MeV; Gradient = 16 MV/m

- The wedge is made of liquid hydrogen with a full angle $\alpha = 77^\circ$ at the vertex
Motivations

- ICOOL works in different ways as GEANT
  In a straight channel ICOOL models
  the solenoid as a current sheet without any
  direct rotation as in GEANT

- GEANT is able to rotate the field for a ring
  then do a linear GRID map interpolation
  I will show it later

- GEANT should tell us the exact coil angle
  and tilts that generate the required fields

- It always good to have a redundant simulation
  for a crucial part of an experiment
Geometry and Material

- Geometry and material in GEANT = ICOOL

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Rotated Constant Field By = 0.1250 T
• **Applied Constant Fields:**

![Graphs showing vertex positions of single particles with statistical data](image-url)
Can GEANT rotate the fields by itself?

- Applied constant fields (0.125 Tesla) into one cell
- Let GEANT rotate the fields by itself
- Locate $\mu^+$ (200 $MeV/c$) at $z=531$ cm

$\Rightarrow$ The $\mu^+$ still follow a closed orbit!
Did GEANT Rotate the Fields Correctly?

- Locate $\mu^+$ at $z=300$ cm and $x=200$ cm

$\Rightarrow$ Indeed $\mu^+$ does not follow a closed orbit!

Constant Field $B_y = 0.1250$ T
GEANT Rotates the Field by Itself
Turn Off RFs and Wedges

Applied Constant Fields
GRID Magnetic Fields

- We implemented GRID map into GEANT then do interpolation ➞ GRID Fields Map
- GRID fields map along arc length:

![Diagram showing magnetic fields along arc length](image-url)
GRID Magnetic Fields

- Fields map output from GEANT is very well match with BIOT fields \( \Rightarrow \) a cross check

- GRID fields map along axis:

![Diagram of magnetic fields](image-url)

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Interpolation Method

- We do check the interpolation method when GEANT read the GRID map \( \Rightarrow \) Fields map

- Fractional difference of True - GRID Fields

\[ db_x = \frac{(B_X - b_X)}{B_X}; \quad db_y = \frac{(B_Y - b_Y)}{B_Y}; \quad db_z = \frac{(B_Z - b_Z)}{B_Z} \]
Magnetic Fields Study

- BIOT-Savart fields is done by Lucien and Don
- BSHEET (ICOOL) is done by Rick and Juan
- Bx fields comparison between BSHEET and BIOT (Integral Method) \(\implies\) GEANT
Bs Fields Comparison of BSHEET-BIOT

- BSHEET-BIOT Bs fields match very well
By Fields comparison of BSHEET-BIOT

- There is still a large discrepancy of $B_y$ that need to understand $\rightarrow$ in progress
Conclusions

- GEANT rotates the fields map correctly. It is very good feature from GEANT.

- GEANT produces consistent fields map output by doing a correct interpolation routine.

- The CODE has installed into CVS repository in Fermilab, thanks to Raja for his help.

- The discrepancy between BIOT-BSHEET in By fields is under studying.

- We are studying the RFOFO RF tuning.