Wiggler Magnetic Field Calculations

Status of work since March 22

1. Peak field in coils for 7-pole wiggler at 161 amps
   - Show fields in arcs as well as in straights
   - Plot $|B|$ rather than B_Y

     $\Rightarrow$ Peak field of $|B| \simeq 5$ T reached in arcs.

2. Systematic effects in Vector Fields calculation
   - Investigate accuracy of tracking

     $\Rightarrow$ Changing step size from 5 mm to 1 mm did not help

     $\Rightarrow$ Jitter in $\Delta\Theta_x$ smaller in 3-pole ($\simeq 50$ μrad) than in 7-pole ($\simeq 100$ μrad)
   - Vary mesh size
   - Effect of outer boundary conditions
   - Effect of flux returns
   - Effect of using quadratic elements
   - Set permeability to 1 in steel

3. Fitting wiggler field
   - DCS fit now running on VF calculation, but fit is high-maintenance

     $\Rightarrow$ χ^2 per point is 40 (for Mermaid it is 20), but needs further work

4. Mermaid field in 7-pole wiggler
   - Plots as for VF now available for course grid (1/16 of VF grid) used by DCS

     $\Rightarrow$ Course grid (1/16 of VF grid) used by DCS
   - Fine grid from MERMAID now ready for analysis

5. Tracking in vertical plane, focusing
   - Vertical displacement as function of vertical entrance position

     $\Rightarrow$ Deviation from pure quadrupole at $y = 2$ cm shows reasonable agreement with MERMAID

6. **Vector Fields calculation for 3-pole 40-cm-period wiggler**

- Horizontal uniformity

  $\Rightarrow$ Better than 0.2% for $|x| < 4$ cm for central and end pole at 161 A

- Linear integeral

  $\Rightarrow$ Much worse than for 7-pole wiggler !!

  $\Rightarrow$ Depends very little on trim coil current

- Tracking trajectories

  $\Rightarrow$ Horizontal exit angle very similar to 7-pole, including trim coil correction. Good correction given by $\simeq$ 10 amps

  $\Rightarrow$ Vertical focusing similar to that for 7-pole wiggler

- *Do we want to compare Vector Fields to the measurements beginning today?*