3-Pole and 7-Pole Wiggler Field Calculations

Systematic studies since March 29

1. **Discovery:**

   The fluctuations in linear integrals and tracking results previously observed disappear when a quadratic interpolation algorithm is used in place of the linear algorithm used until now.

2. **Tracking in 7-pole wiggler field**
   - Horizontal deflection versus horizontal entrance position

     ⇒ Now good agreement with DLR result from tracking software
     (Difference due to different B-field, see wiggler field fitting below)

     ⇒ Good correction requires more than 10 amps in trim coil

3. **3-pole 40-cm-period wiggler**
   - Horizontal uniformity shows good agreement with measurement

     ⇒ Better than 0.2% for $|x| < 5$ cm for central and end poles at 161 A (2.1 T)

     ⇒ 1% variation up to $|x| = 5$ cm for central and end poles at 110 A (1.7 T)
   - Linear integral uniform and small ($\lesssim 2$ gauss-m)
   - Tracking trajectories

     ⇒ Horizontal exit angle variation smaller than in 7-pole
     Good correction requires more than 10 amps in trim coil

4. **Gap increased by ± 1 mm in 7-pole wiggler calculation**

5. **Systematic effects in the 7-pole wiggler calculation**
   - Change outer boundary conditions from tangential to normal

     ⇒ Peak field difference $< 10^{-4}$, linear integral $\lesssim 1$ gauss-m
   - Decrease mesh size in steel from 1 cm to 0.6 cm

     ⇒ Peak field difference $< 10^{-4}$, linear integral < 0.2 gauss-m

- Increase mesh size in beam region from 2 mm to 4 mm
  - $\Rightarrow$ Error bars increase, B_Y changes at 10^{-4} level
  - $\Rightarrow$ Linear integrals change by $\simeq 0.5$ gauss-m
- Effect of flux returns on end plates

6. **Set permeability to 1 in steel to see coil fields alone**

- Coil currents contribute about half of peak field

7. **Fits to the 7-pole wiggler field**

- Found that coarse Mermaid field x-dependence different from recent fine-grain grid (see 22 March)
- Showed that Mermaid/VF calculation on same fine grid agree at 10^{-4} level (see 29 March)
- First DCS fit results for VF calculation obtained, but needs work