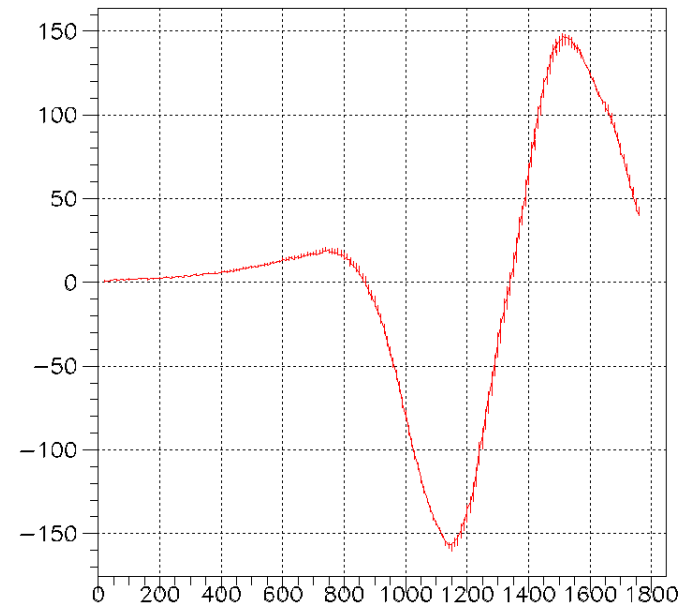
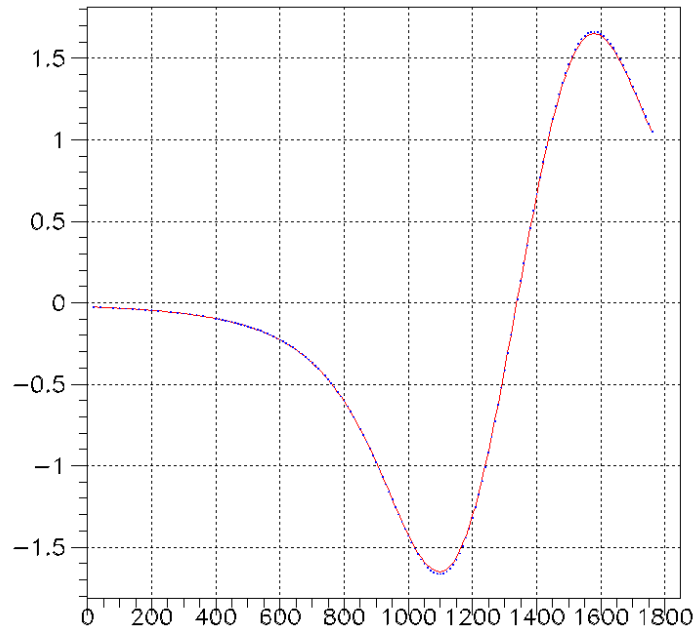


FITTING FC DIMENSIONS – 1st Try

2016/04/21 12.30

2016/04/21 12.3



Bz (Tesla) on axis versus z (mm)

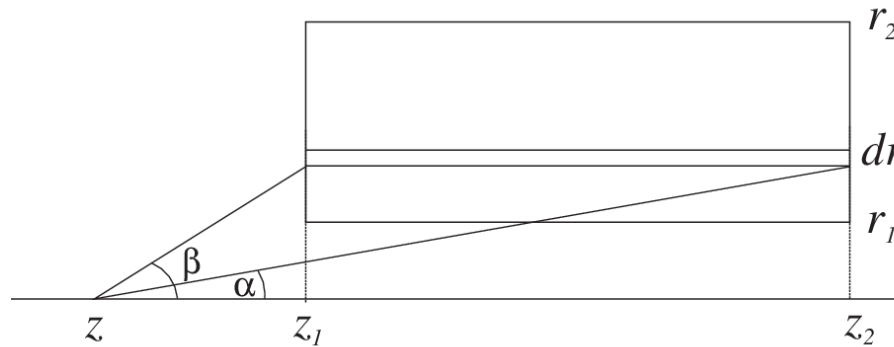
Red = calculated from nominal cold dimensions

Blue points = measurements (Probe 0)
8 phi values, Forward & Backward

Difference (Gauss)

**Measurements & calculations
agree to ~ 1%**

FITTING



- Use Block Coils
 - Field on axis of single block coil is:

$$B_z = \frac{\mu_0 NI}{2(r_2 - r_1)(z_2 - z_1)} \left\{ (z_2 - z) \ln \left[\frac{\sqrt{(z_2 - z)^2 + r_2^2} + r_2}{\sqrt{(z_2 - z)^2 + r_1^2} + r_1} \right] - (z_1 - z) \ln \left[\frac{\sqrt{(z_1 - z)^2 + r_2^2} + r_2}{\sqrt{(z_1 - z)^2 + r_1^2} + r_1} \right] \right\}.$$

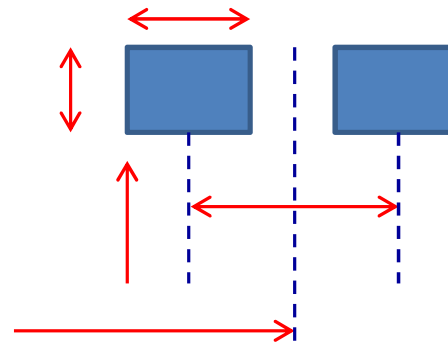
- First factor is scale; term in { } determines *shape*
 - *Note logarithmic dependence of shape on parameters*

PARAMETERS

- Assume the two coils in a module are identical

- 6 parameters:

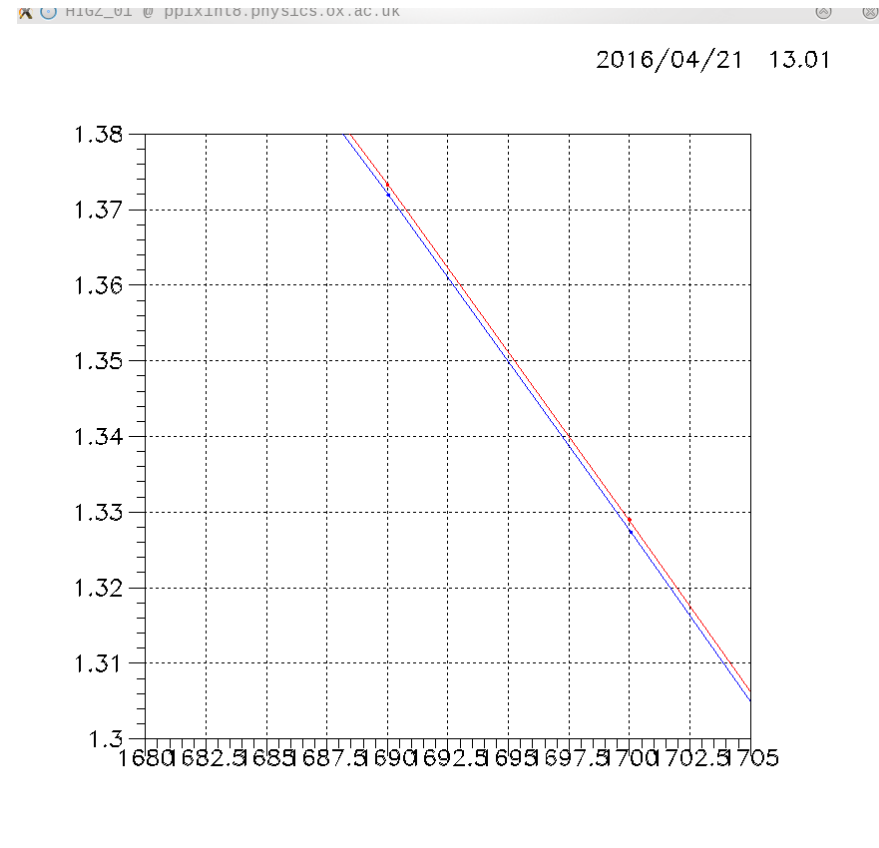
- Thickness
- Length
- Inner radius
- Separation between centres of coils
- Mid-point of coils
- Scale factor for current



- Simple gradient minimiser

BACKLASH

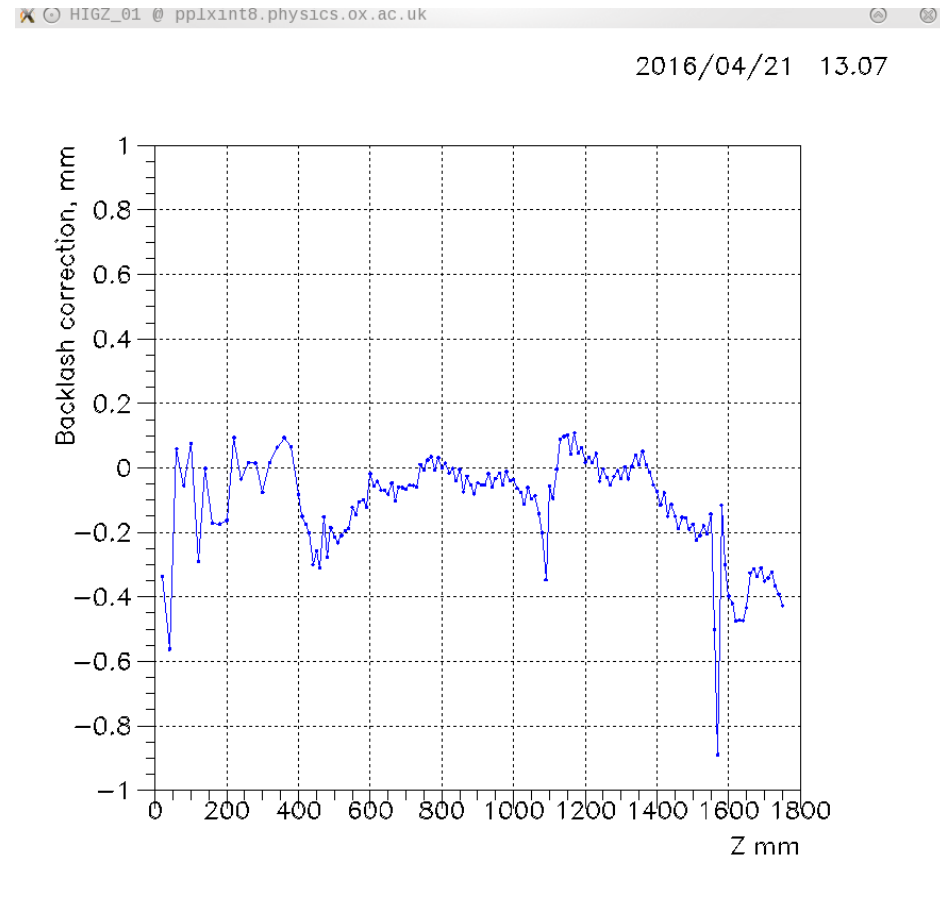
- Z read by Mapper differs from true Z depending on direction of travel (Forward or Backward)
- Significant error
 - big effect on fit residuals
- Determine **point-by-point** correction to line up F and B
- $dz = dB / (dB/dz)$
 - dB/dz from data
- Single number not good enough



Bz versus z
Blue Forward
Red Backward

BACKLASH CORRECTION FC2 100A

- **0.1 to 0.4 mm**
- **Note:**
 - dB/dz is 5 – 10 T/m
 - i.e. 5 – 10 gauss / 0.1 mm
- **Backlash is significant**
- **Attributable to mechanics of mapper**
 - **Stretch of belt &c.**

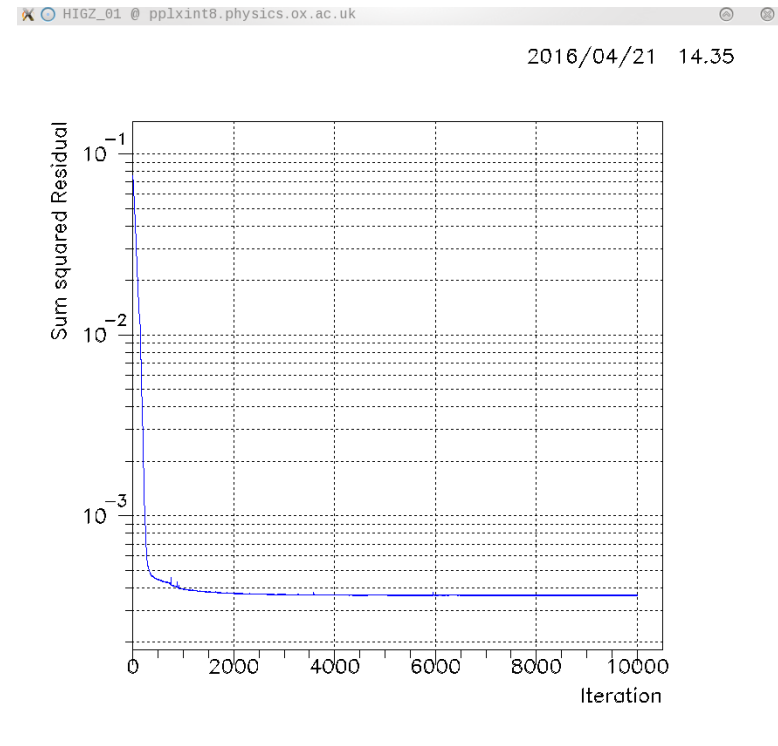


FIT RESULTS – 1

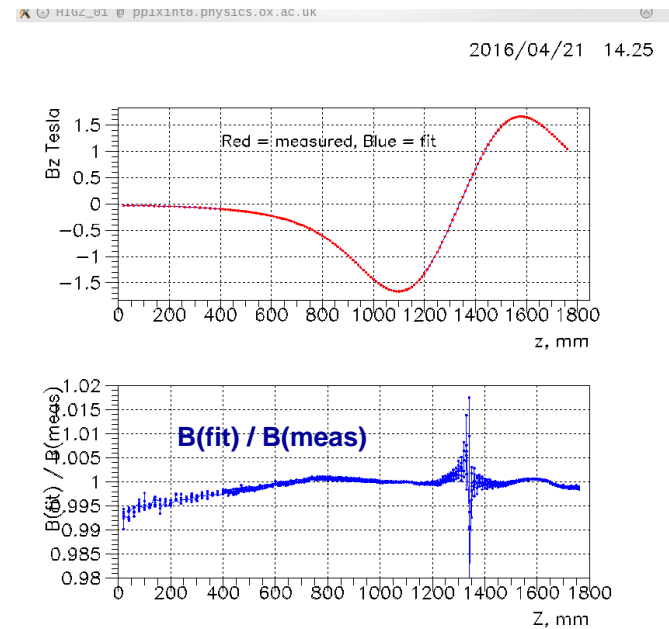
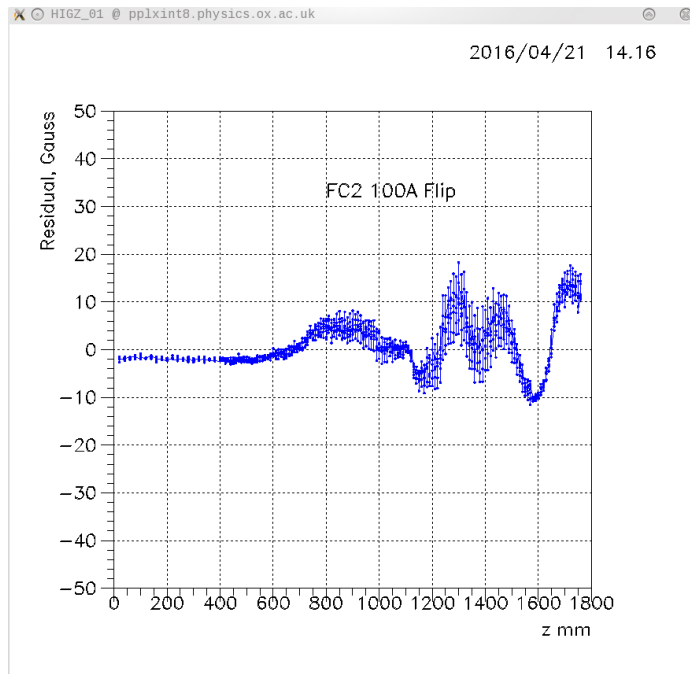
- Fit converges rapidly
- Best fit shifts (FC2):

Scale	0.00048116
Inner radius	-2.222 mm
Separation	-1.747 mm
Length	-0.680 mm
Thickness	-0.946 mm
Centre	0.054 mm

- Quite similar results for FC1
- Surprised by -2.2 mm decrease in inner radius
 - Possible that solution is not unique



FIT RESULTS – 2



- **Fit looks fairly good**
 - **Still some obvious systematics**
 - *Non-linearity between Mapper z and true z ?*
 - **Mean Bfit / Bmeas = 0.9994, rms = 0.0023 (0.23%)**
 - **(how well do we know p_mu?)**

TO DO

- Investigate;
 - Systematics a bit more
 - Other 'solutions' ?
- How far to take this/
 - i.e. when to stop?
 - Optics question!