

FOCUS COIL STATUS

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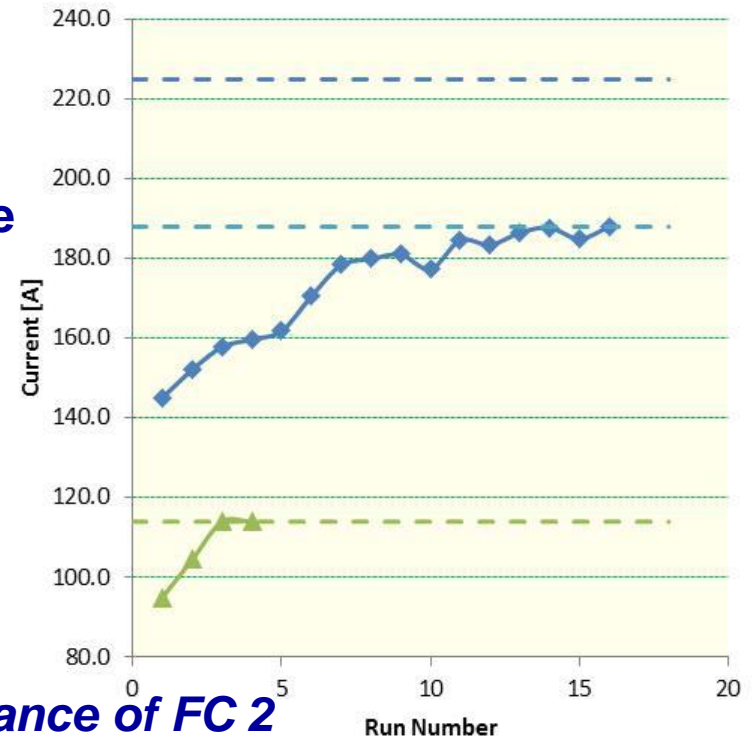
C. White

OUTLINE

- **Reminders**
 - FC 1 history
 - FC 2 history
- **FC 2 repair**
- **FC 1 rides again**
 - Stability
 - Mapping
 - (re)-Training
 - Flip – Solenoid – Flip
- **Plans**

FC 1 HISTORY

- **Trained Feb – Oct 2013**
 - Full current – 114 Amp – Solenoid mode
 - 188 Amps Flip mode – *just*
 - 200 MeV/c ‘baseline’
 - **No overhead**
 - Stability not tested
- **Training stopped when FC 2 arrived**
 - *Fate of FC 1 was to depend on performance of FC 2*
- **Known faults corrected January 2014**
 - Tension on CM supports increased
 - Insulation between stages of cryocoolers added

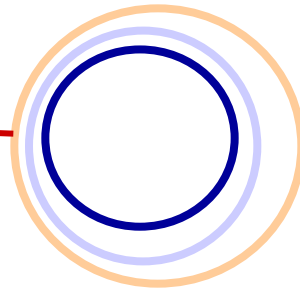
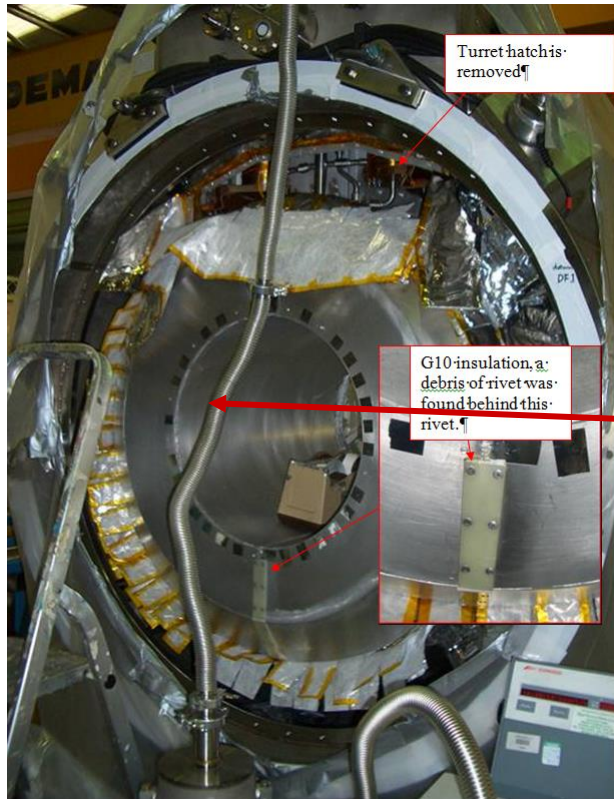


ENTER – AND EXIT – FC 2

- **FC 2 arrived end October 2013**
 - **Connected**
 - **Pumped down**
 - **Started to cool with cryocoolers**
- **Three faults:**
 - **Faulty temp. sensor**
 - **He leak**
 - **Worse when cold**
 - **Thermal shorts**
 - **Couldn't cool cold mass...**
- ***Returned to manufacturer***



FC 2 INVESTIGATIONS

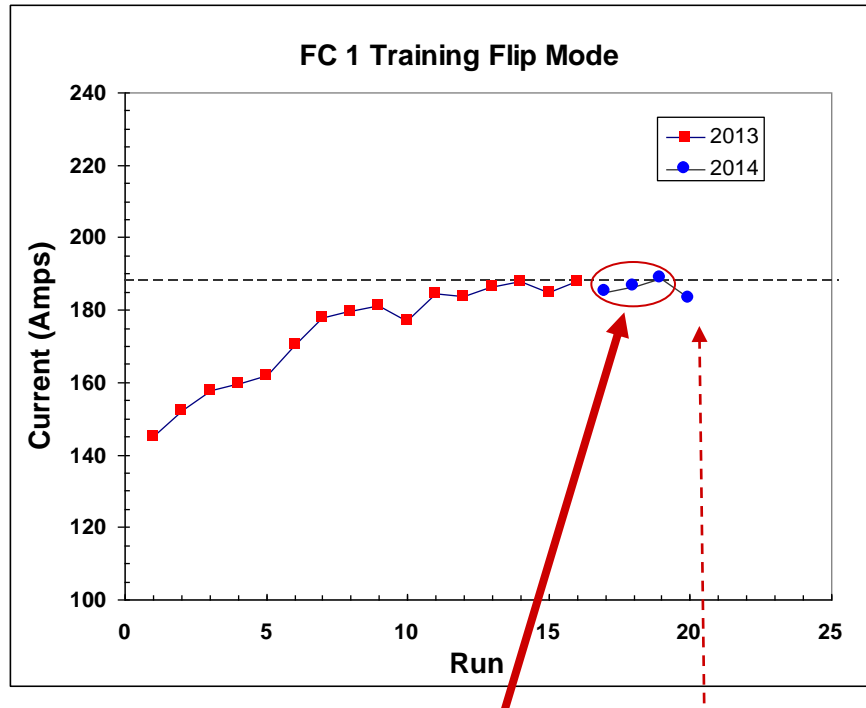


- Forensic disassembly established source of thermal shorts:
 1. Cold mass / rad. shield / warm bore tube not concentric
6mm clearance reduced to 3mm → compressed MLI
 2. Debris of pop-rivet on radiation shield impinging on cold mass
- Calculations agree with observed thermal loads

FC 2 REPAIR

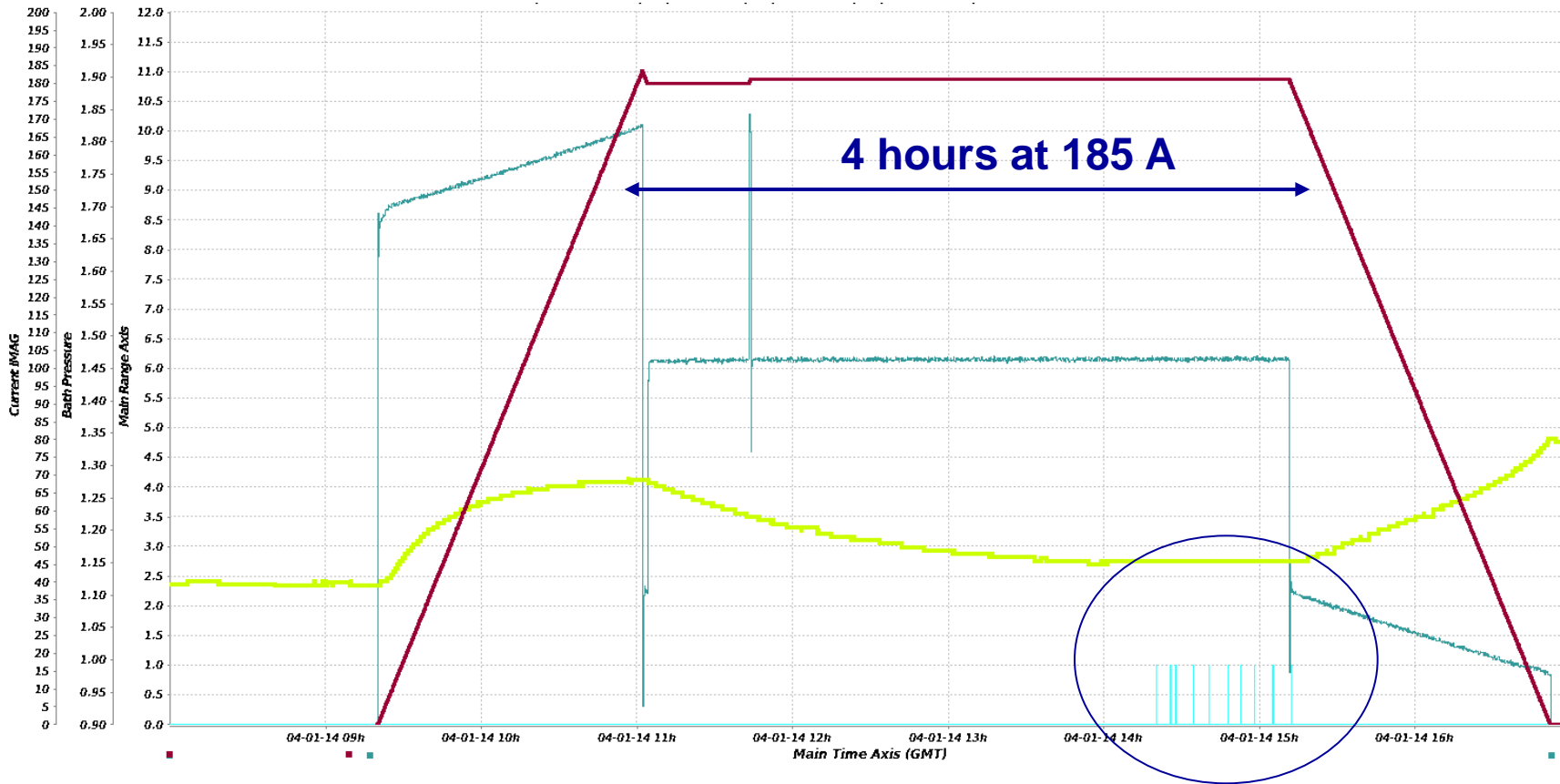
- He leak is somewhere on cold mass
- **Decided – with manufacturer – *not* to remove cold mass to fix it**
 - Like brain surgery
 - Risk to connections to cold mass, leads...
 - Impossible to test *cold* at manufacturers
- **Want to assess *electrical* performance of FC 2**
 - To inform FC 1 decisions
- **Manufacturer has:**
 1. Replaced thermal sensor & wiring
 2. Added spare sensor
 3. Reassembled carefully
- **Delivered late May**
 - Helium leak marginally worse when warm

FC 1 RIDES AGAIN



- **Three training runs after warm-up**
 - **It remembered its training !**
- **First estimate of stable operating current *in R9* was 185 Amps**
 - **Two stable 4-hour runs at 185 Amps**
 - ***Quenched at 183 Amps on third attempt***
- **Stable at 180 Amps for two 24 hour runs**

CRYOCOOLER PERFORMANCE

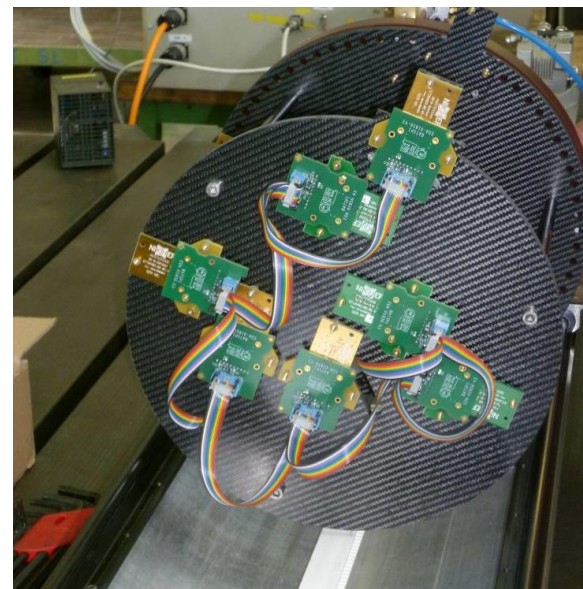


He bath heater activating at full current → excess cooling capacity

But marginal

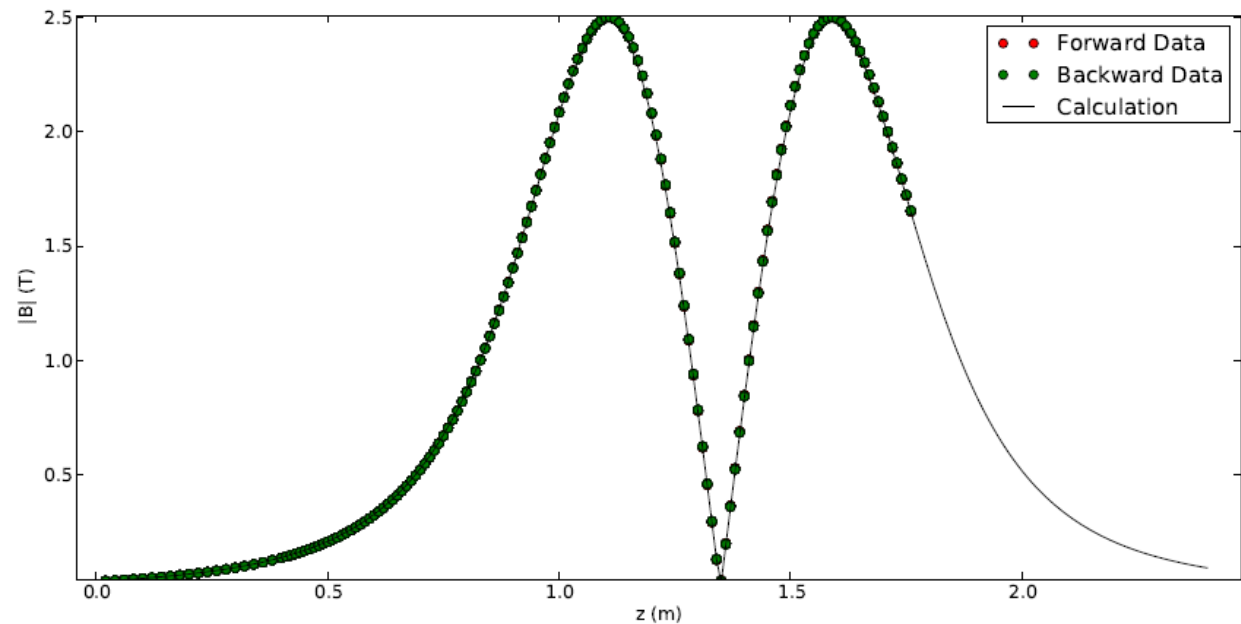
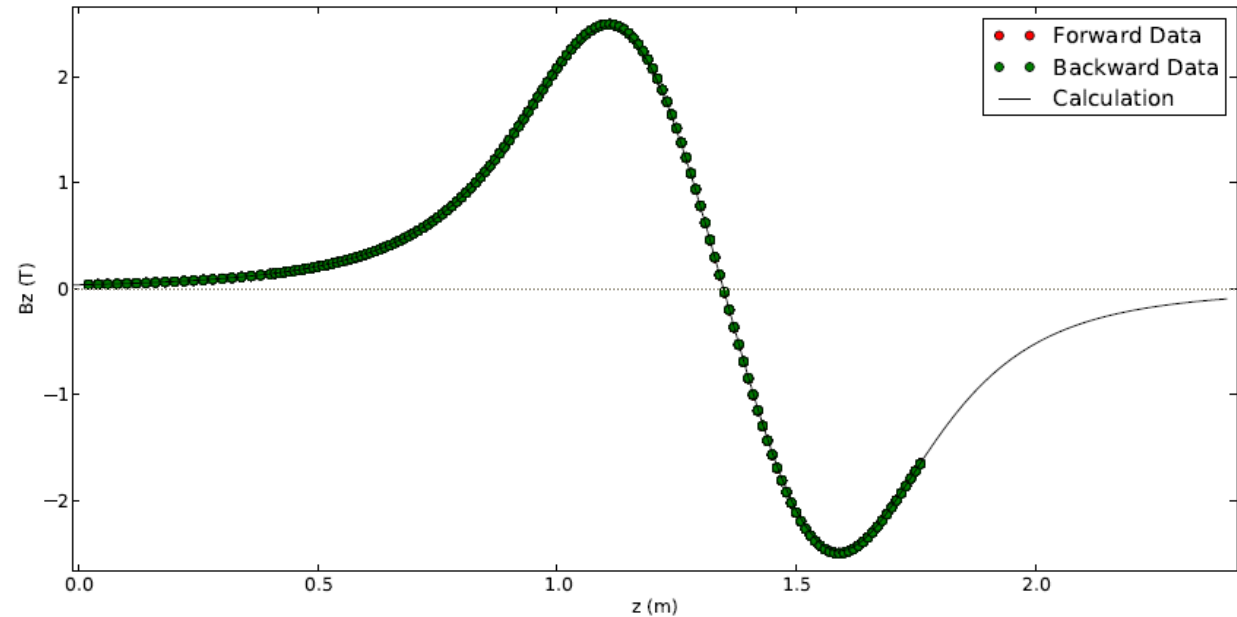
MAPPING FC 1

- Spent ~ two weeks at end of May mapping with CERN mapper
 - Flip mode then solenoid mode
 - $120 \text{ Amps} = 240 \text{ MeV}/c + 5\%$
 - Then back to flip mode
 - To see what happens...
- Quasi-infinite number of measurements
 - ~ 450,000 points
 - **Will take some while to digest**
 - More details in V. Blackmore's talk in analysis // session
 - Example follows



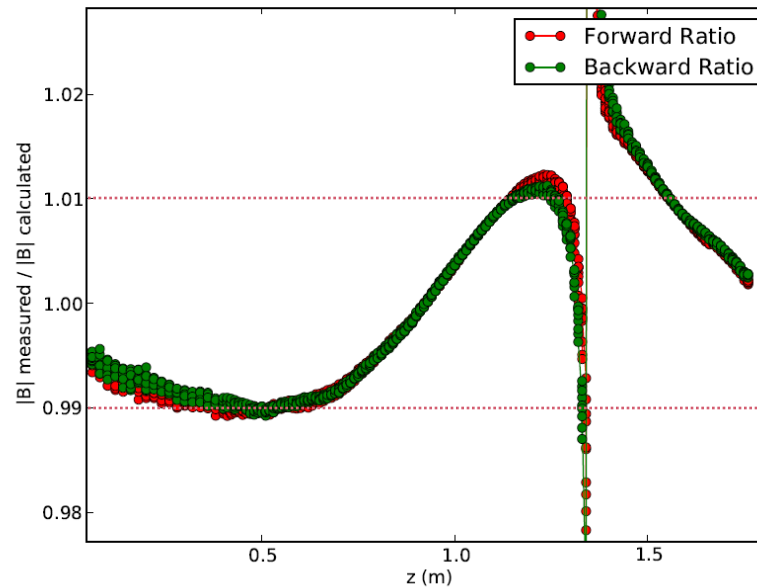
Comparison to calculation

- Flip mode
- 150A
- Mapper takes data in both directions of travel – requires some correction (see later)
- Top: B_z from mapper
- Bottom: $|B|$ from mapper – avoids the question of Hall probe alignment w.r.t. the field
- Negligible difference between B_z and $|B|$



Comparison to calculation

- Solenoid mode
- 100A
- Mapper takes data in both directions of travel – requires some correction (see later)



Ratio of measured to calculated field in Flip Mode at 150A

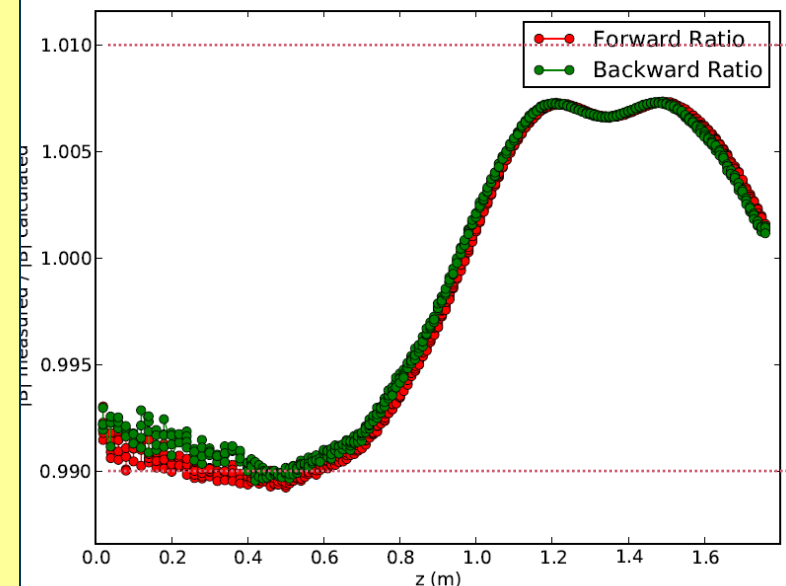
+ 0.8 to 1% difference between measured and calculated fields

Also seen with ‘probe on a stick’

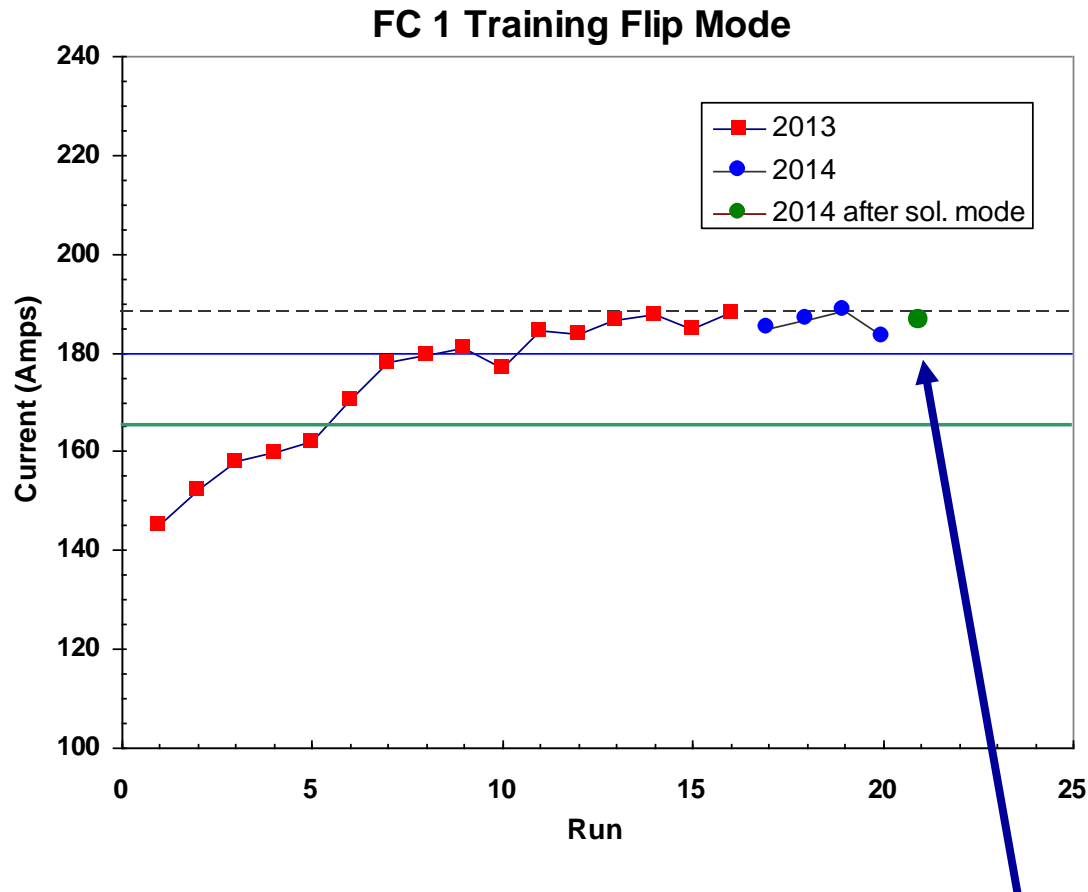
Surprisingly large \rightarrow Δ thickness \sim - 5 mm

Need to check nominal dimensions of coils with manufacturers

Idea is to fit (4 parameters) coil dimensions



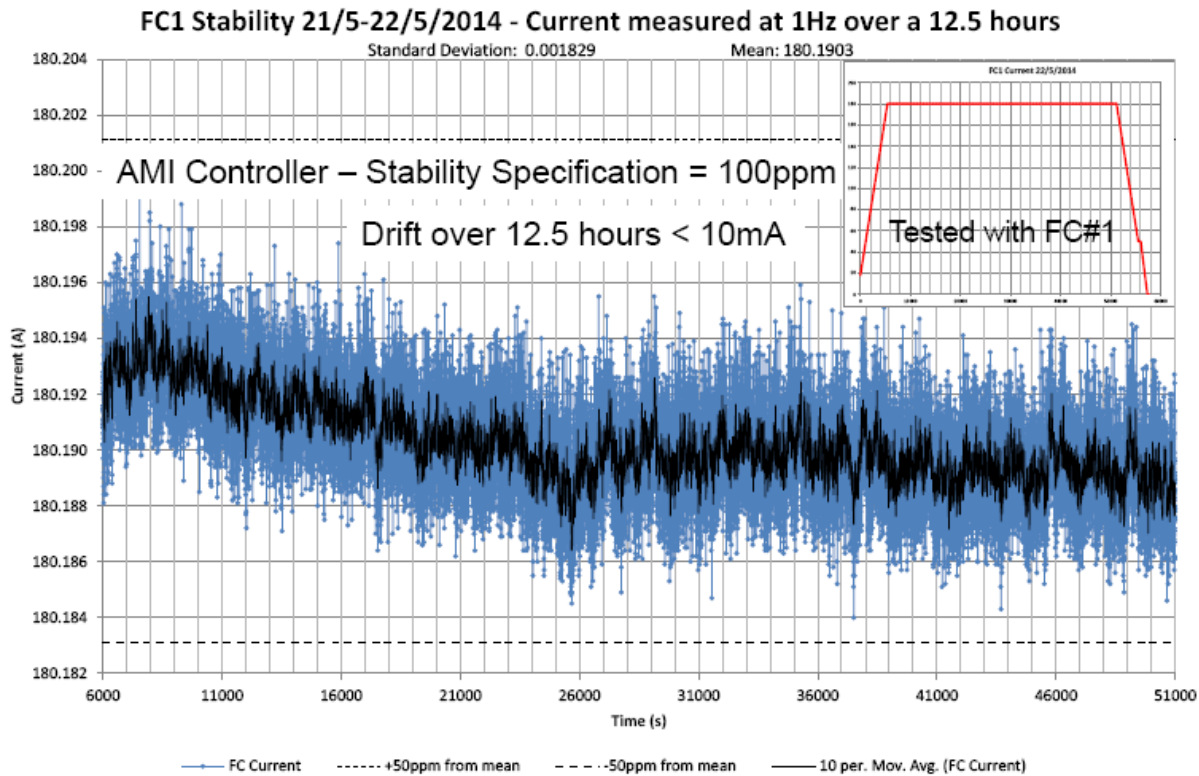
FC 1 AFTER SOLENOID MODE



It went straight to 186.5 Amps before quenching

→ Still remembers its training

PSU STABILITY



Checked by DL team

Better than 60 ppm in 12 hours

Absolute calibrations agree to ~ 1.1 parts / 1000 (0.11 %)

FC 1 & 2 PLANS

| <i>FC 2</i> | <i>Start</i> | <i>Duration</i> |
|-------------------------------|---------------------|------------------------|
| Cooldown | 2 Jul | 3 weeks |
| Solenoid mode training | 24 Jul | 2 weeks |
| Flip mode training | 7 Aug | 10 weeks |

Know by mid-September if FC 2 better than FC 1

Know much sooner if He leak is a real problem

FC 1 work before south side PRY:

LH2 turret leak test using dummy windows

Receive real absorber windows, fit & insert absorber

Re-commission LH2 vacuum system

Leak tests using actual windows and vacuum system

FC 1 GOES TO A NEW HOME



Moved to Hall 19 June