IP Quadrupole cables in IRs 1 and 5

Originally : Nothing on ratio constraints in design report, High-β designed without ratio constraint

D. Nisbet LMC#10 15/04/2009 return cables Q4 - Q10, remove 0.5 < b1/b2 < 2 ratio constraint

F. Duval LMC#31 07/10/2009 integration of 3 cables (L/R) possible, cost ~ 110 kCHF / IP

H. Burkhardt LMC#32 14/10/2009 preference for adding 2-3 cables each side rather than polarity switch on Q4 with **DECISION: The LMC approved the preferred solution (extra cables)** for the TOTEM high-β optics **including a few additional cables, to be applied in IPs 1 and 5**

H. Burkhardt LMC#132 09/05/2012 add 4x3 cables L/R of **IP1 and IP5**, confirming decision to order cables problem is time in overloaded LS1 schedule, installation waiting for directorate decision

H. Burkhardt LMC#150 26/09/2012 High-beta results, MD plan, and cables

S. Chemly LMC#177 02/04/2014 possibility to fit cable installation for Q4 in points 5 in tight LS1 schedule request to accompany installation with ECR :

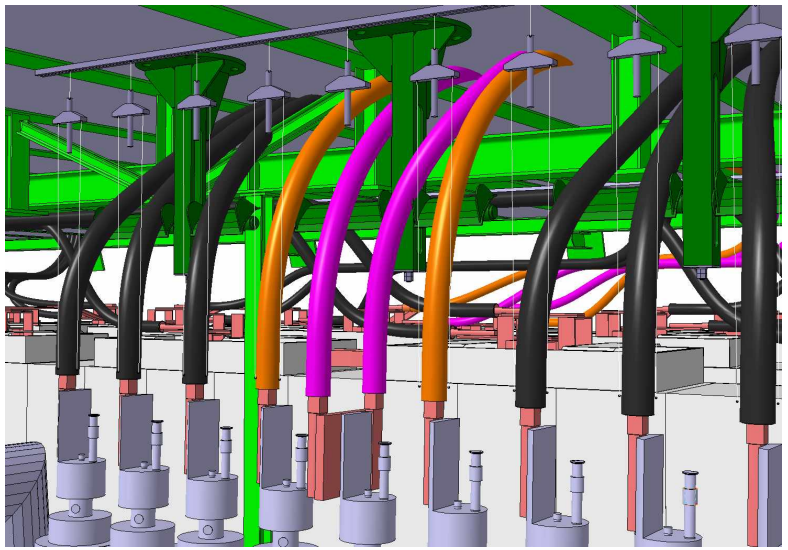
LHC-LJ-EC-0042 25/06/2014 , Electrical Circuit Change for High Beta Optics in IR1 and IR5 of the LHC

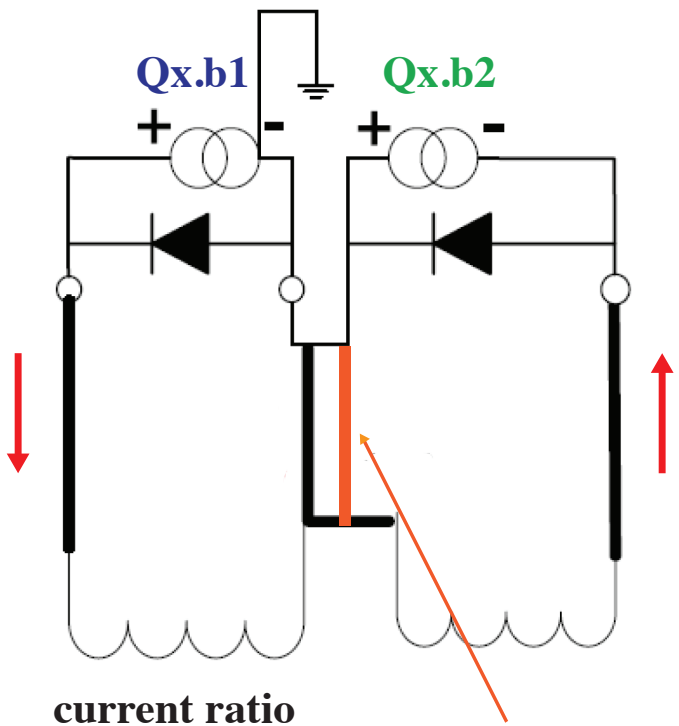
by V. Montabonnet TE/EPC, H. Burkhardt BE/ABP, J.-C. Guillaume EN/EL

Extension to IR1, nothing new, still accompany by another ECR, applying to IR1 what was done in IR5 discussed in **LMC#198** 10/12/2014 **not urgent**, should just be done, makes sense to wait for results from tests

The current ratio constraint

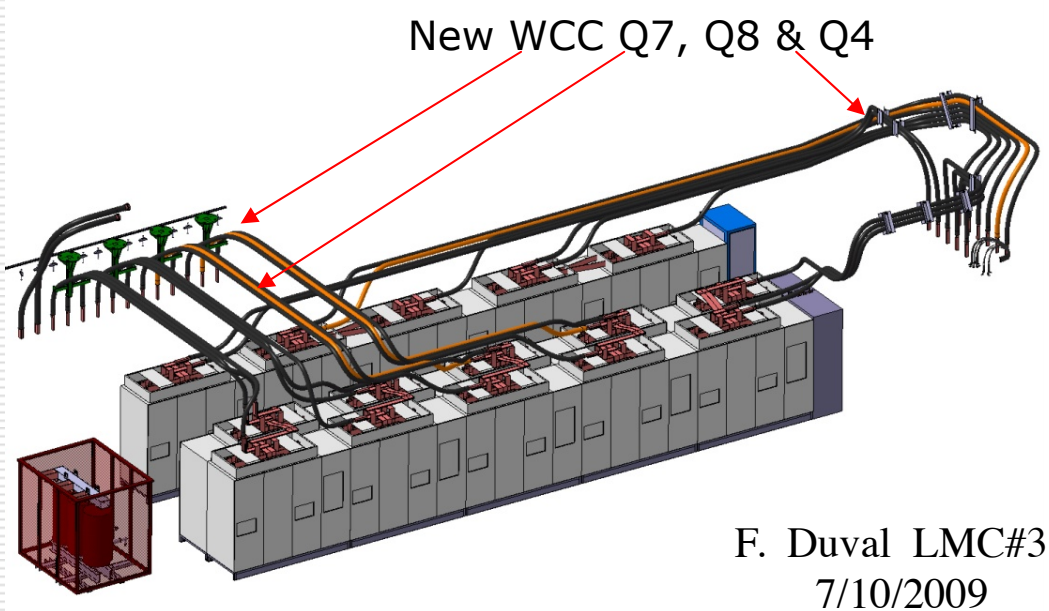
Limits matching of phase advance and flexibility to reach high β with phase constraints to roman pots





current ratio constraint
0.5 < b1 / b2 < 2

removed with a 2nd return cable

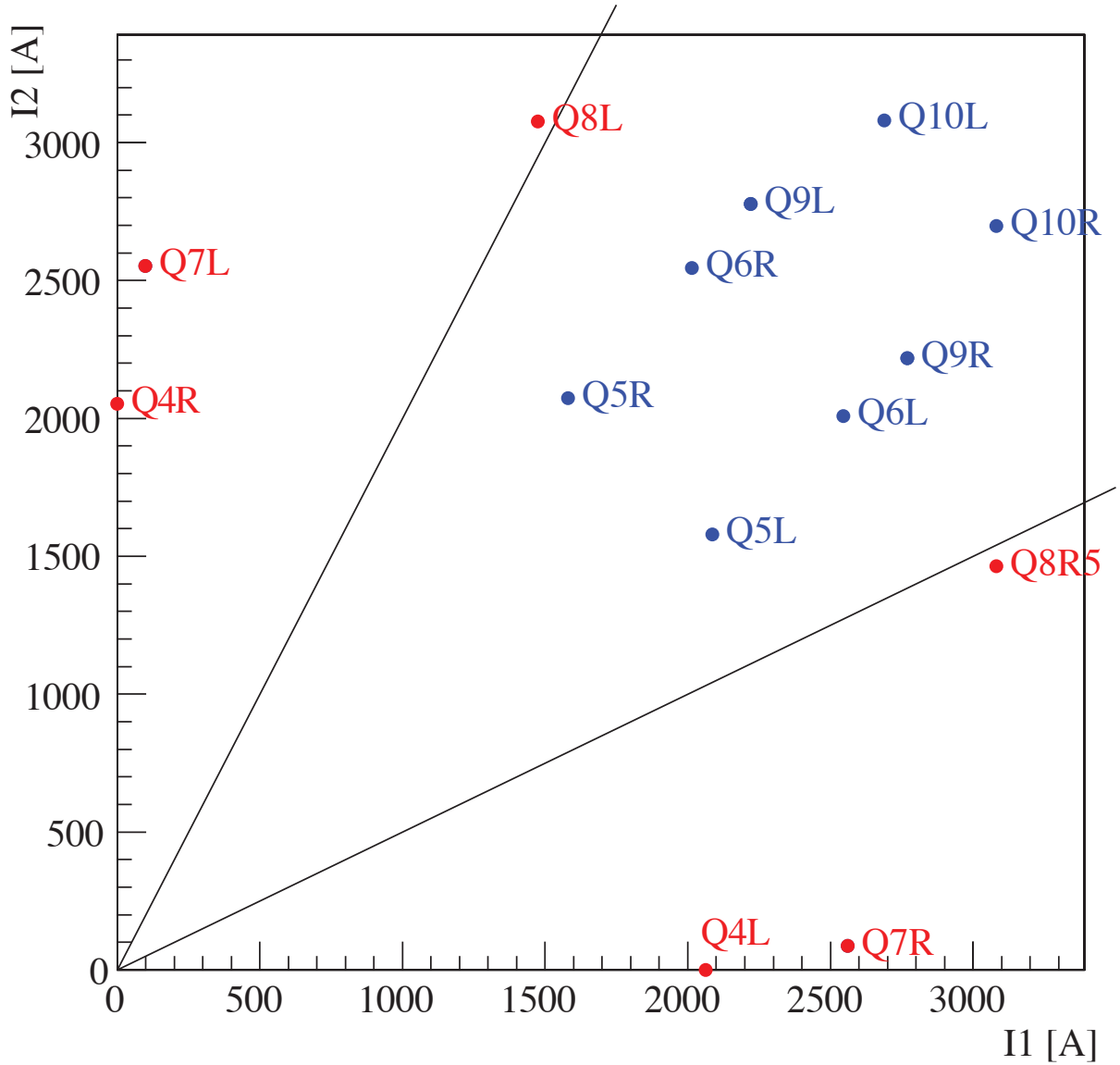


F. Duval LMC#31
7/10/2009

Nominal 7 TeV β* = 1535 m TOTEM optics

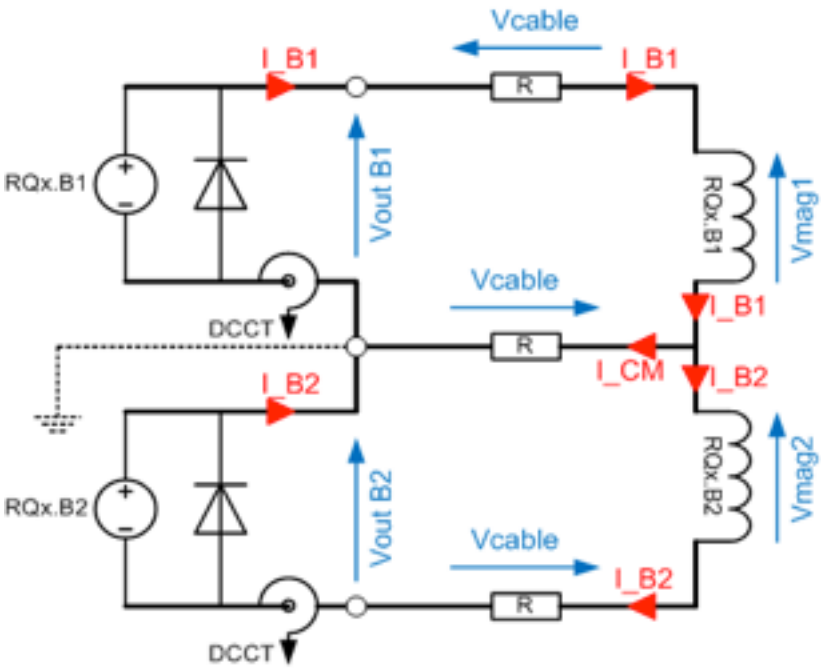
strength file k1535v65.230205, **A. Verdier, LHC Project Note 369, 20 May 2005**

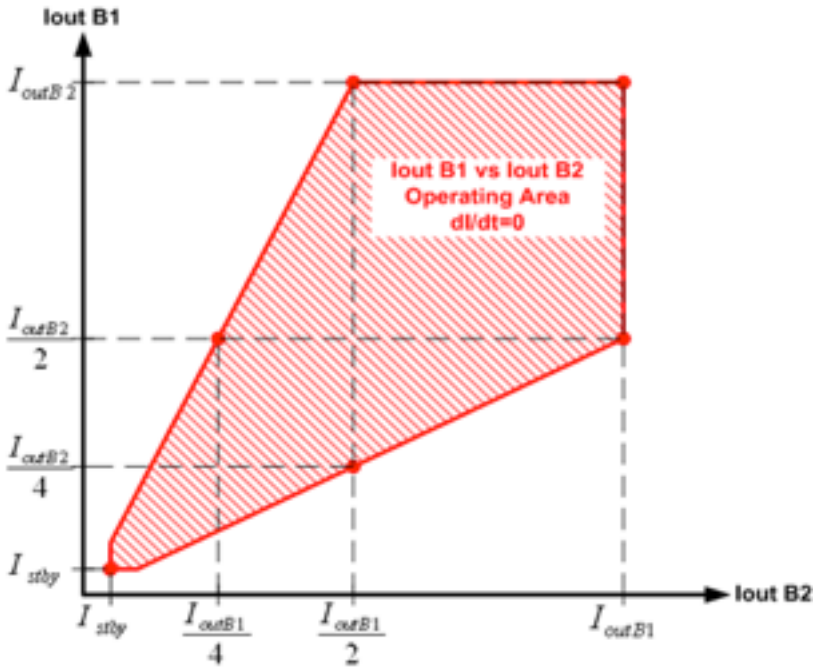
Phase advance of ~ 90° between IP and Roman pots in both x and y



3 magnets each left and right outside the ratio 2 limits, for Q4, Q7 by a lot :
Over 2000 A on one beam and close to zero on the other beam

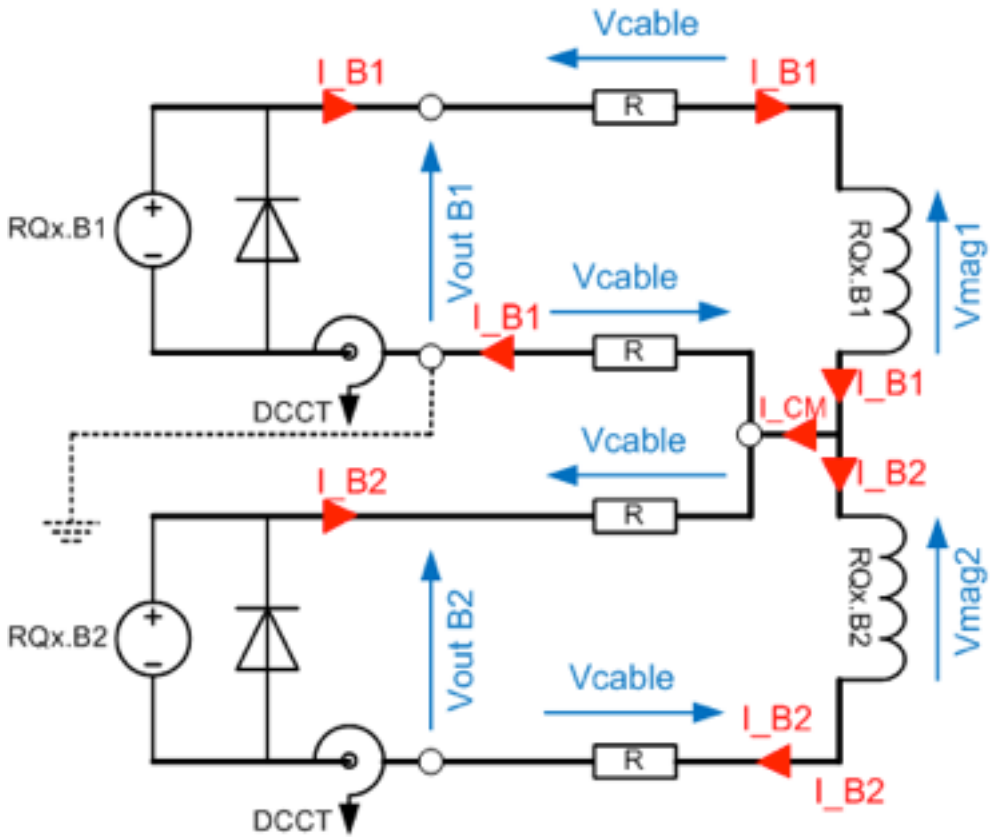
Existing situation, as described in ECR LHC-LJ-EC-0042





MQM - MQY circuit powering
Q 4, 5, 6, 7 , 8 , 9, 10

Constraint removed with 2nd return cable

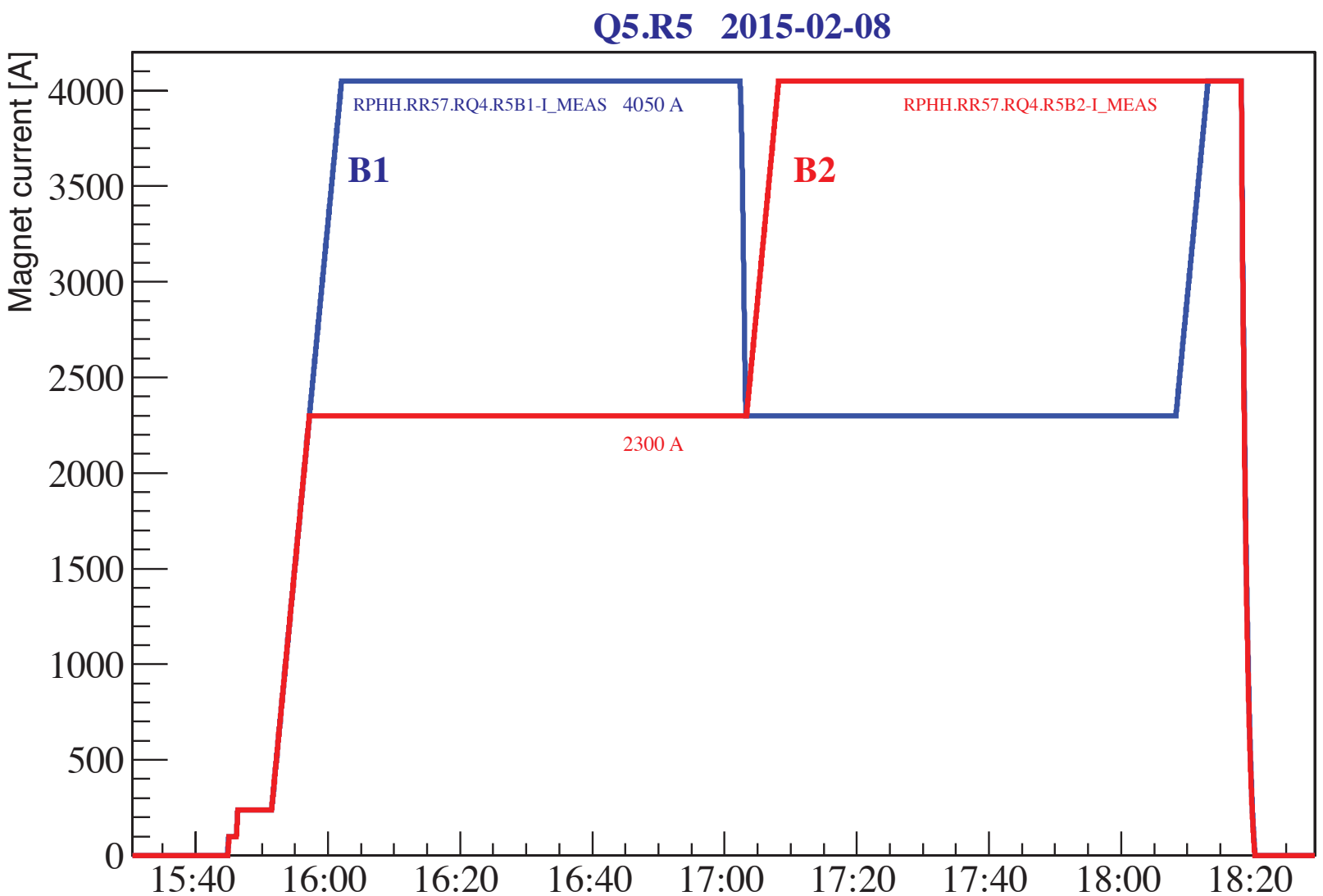


Magnets : ideally Q4 - Q10

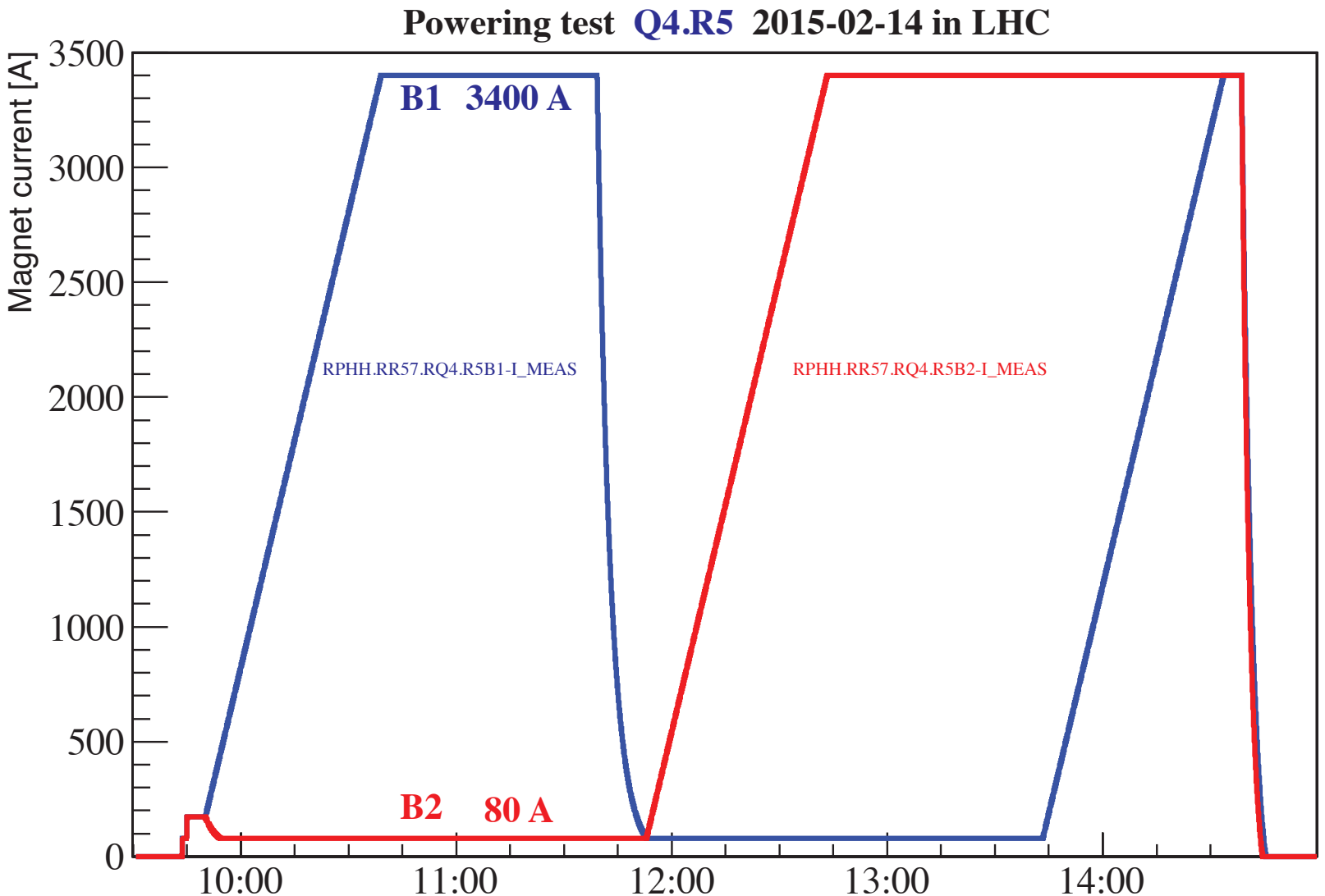
Priority : most important Q4

then Q8, Q7, and if possible still Q10

Recent powering tests, example of Q5.R5 with “old” cabling



Q4.R5 with new cabling



Works as expected -- apply to Q4 in IP1 asap !!