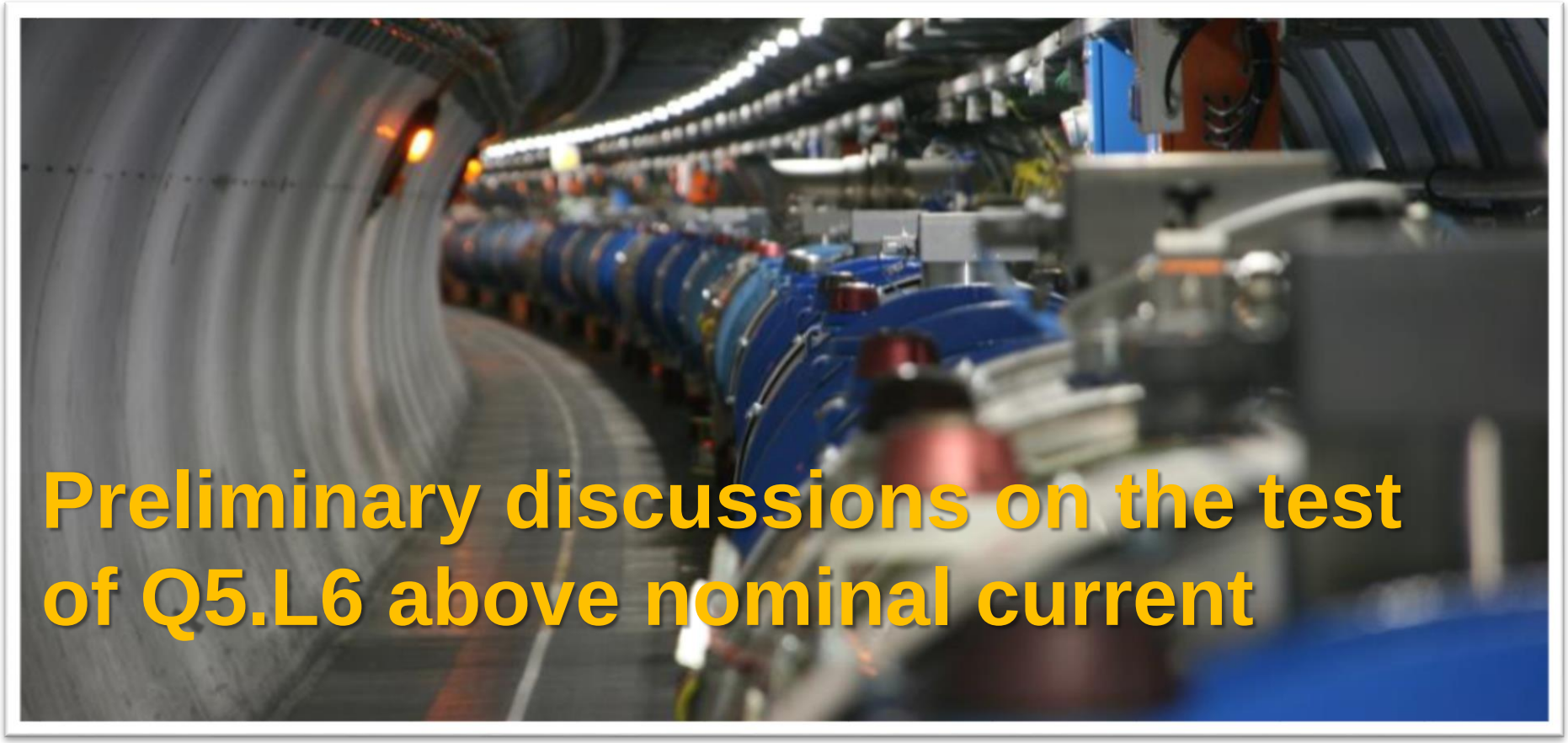

CERN



Preliminary discussions on the test of Q5.L6 above nominal current

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From Layout database

RQ5.L6 : Matching section individually powered Quadrupole **Link to MTF**

ID : 184909, Circuit version : STUDY, Layout version : STUDY

Power Converters in the Circuit	PC Location	Rack Name/Slot
RPHH.UA63.RQ5.L6B1 (MTF, TE-EPC Database)	UA63/GA	
RPHH.UA63.RQ5.L6B2 (MTF, TE-EPC Database)	UA63/GA	

Magnets in the Circuit	Number
MQY	2

Current Leads in the Circuit

DFLCS.A5L6.1
DFLCS.A5L6.2
DFLCS.A5L6.3

Magnets per Power Converter

RPHH.UA63.RQ5.L6B1

MQY — 1

I Nominal :	3610 A	I Ultimate :	3900 A		
I Offset :	.0 A	I Overload :	1.03 * I ultimate A	I Min Op :	80.0 A
L tot :	.074 H	R tot :	.000843 Ohm	R tot Measured :	.000389 Ohm
Ramp Time :	360.00 s	max(di/dt) :	10.833 A/s	Time Constant :	87.587 s
U leads :	.120 V	U Extr :	.000 V		
U Boost :	.799 V	U Coll :	3.370 V	U Peak Circ :	4.170 V
Warm Cable Verification :	✔				

160 T/m

RPHH.UA63.RQ5.L6B2

MQY — 1

I Nominal :	3610 A	I Ultimate :	3900 A		
I Offset :	.0 A	I Overload :	1.03 * I ultimate A	I Min Op :	80.0 A
L tot :	.074 H	R tot :	.000843 Ohm	R tot Measured :	.000400 Ohm
Ramp Time :	360.00 s	max(di/dt) :	10.833 A/s	Time Constant :	87.587 s
U leads :	.120 V	U Extr :	.000 V		
U Boost :	.799 V	U Coll :	3.370 V	U Peak Circ :	4.170 V
Warm Cable Verification :	✔				

Circuit Parameters

Operational Temperature : 4.5 K

HL-LHC request (180 T/m, 4.5/1.9 K)
Beam 1 -> 4060 A
Beam 2 -> 3750 A

Hardware feasibility_1

- PC-power part (V. Montabonnet)
- For the RQ5.L6 circuit, the PC is a RPHH type, equipped with 3 * 2kA sub-converters and a 4 kA DCCT
  - No problem from power side, being able to reach 6 kA
  - Only the I_hardware limit should be changed in the tunnel

- DCCT (G. Hudson and M. Martino)
- The specifications of the 4 kA DCCTs are as follows:
  - 105% of nominal: continuous operation (accuracy/precision performance should be “nominal”)
  - 110% of nominal: 5 seconds operation
- “So, as your tests will be at 105%, the time at 4.2kA is unlimited”

No limit from PC

Hardware feasibility_2

- Cables
- “Selon ma doc (schémas DC et cmdes WCC) , l'intensité max est de 3.9 kA. La longueur du circuit est de 44m. La section est de 1000mm2; ce qui laisse un peu de marge pour aller plus haut. Il faudrait vérifier les aspects chute de tension et débit d'eau avant de passer à 6 kA le cas échéant et faire une ECR (?)”

No problem to operate at 4.2 kA

Performance aspects

- Performance in SM18 (S. Lenaour)

Quench table for magnet 'SSS658' on bench TBD2

-	File	Test	Current	Location	TT821	MIITS	Comment	Result
1	-	PT 4 Slow power abort check	310	-	4.4	0	OK.	OK
2	A0605140719.he01	PT 5.2 1.5 KA Quench HF	1500	ExtMQY32	4.67	0.2	No alerts	OK
3	A0605140829.na01	PT 6.1 Training 1	3686.5	ExtMQY34	4.6	1.92	No alerts	OK
4	A0605141049.na02	PT 6.2 Training 2	3764	E-M-P12	4.66	2.04	ok	OK
5	A0605141614.na03	PT 6.3 Training 3	3745	I-M-34	4.654	1.99	.	OK
6	A0605141858.na04	PT 6.4 Training 4	3849	E-M-34	4.7	1.96	.	OK
7	A0605142156.na05	PT 6.5 Training 5	3880.7	Ex_MQ_34	4.65	1.96	No AQA message	OK
8	A0605150117.u01	PT 7 Magnet Trained	3900	-	4.65	0	OK	OK
9	A0605150351.hg01	PT 10.1: Prov. Quench 1/2 HF 11850	3606.7	Ex_MQ_34	4.71	1.69	No AQA message	OK

- MP3 advice (A.Veweij):
  - RQ5.L6 only had 2 training quenches in the LHC, both between 3.5 and 3.6 kA.
  - “If I am well-informed, the temp. margin at 4.5 K, 4.1 kA is about 0.47 and 0.28 K (for inner and outer layer cable resp.).
  - If approved, then I do not see a problem in trying to push it to 4.1 kA, possibly with a predefined maximum number of training quenches”

Equipment responsible (L.Bottura)

“I do not see counter-indications to this test, provided the results are followed up as appropriate to guarantee the integrity of the cold mass, cryomagnet and circuit. I would specifically recommend to verify after each quench (especially above nominal) at

- peak voltage (magnet and quench heaters)
- MIIts and hot-spot
- cryogenic conditions (pressure)

to make sure that you remain within allowables. Behaviour at 4.2 is known to be somewhat erratic. It may also be good to perform long-term powering tests to verify stable operation at a current qualified after a successful training quench”