

Situation of the MQTL magnets

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- **Facts from production and measurements**
- **Optics considerations**
- **Outlook**

Facts from production and measurements - I

- MQTL quadrupoles are installed in:
 - Q7-Q11 (MQTLI).
 - Q6 in IR3 and IR7 (MQTLH).
- The two apertures are independently powered.
- MQTLH and MQTLI differ only for the operating temperature
 - MQTLH -> 4.5 K (nominal: 400 A, 90 T/m)
 - MQTLI -> 1.9 K (nominal: 550 A, 125 T)
- Similarly to the other corrector magnets, MQTLs feature fully epoxy impregnated coils.

Facts from production and measurements - II

- **Production is very late!**
- **Production process:**
 - **MQTLI**
 - Modules, i.e. single aperture elements, are built either at **CERN** or at **ANSALDO**
 - **ANSALDO** assembles the modules into a complete quadrupole
 - **ACCEL** assembles the quadrupole delivered by **ANSALDO** into the final cold mass
 - **MQTLH**
 - Modules, i.e. single aperture elements, are built either at **CERN** or at **ANSALDO**
 - **ANSALDO** assembles the modules into a complete quadrupole
 - **CERN** assembles the quadrupole delivered by **ANSALDO** into the final cold mass
- **Production at ACCEL cannot be stopped!**
- **CERN commitment: about 5 magnets/month for a total of 36 by end of 2005 -> delivery to ACCEL should start by end of May**
- **Production of first MQTLH magnets should start at beginning of 2006: tight schedule! It might affect sector test...**

Facts from production and measurements - III

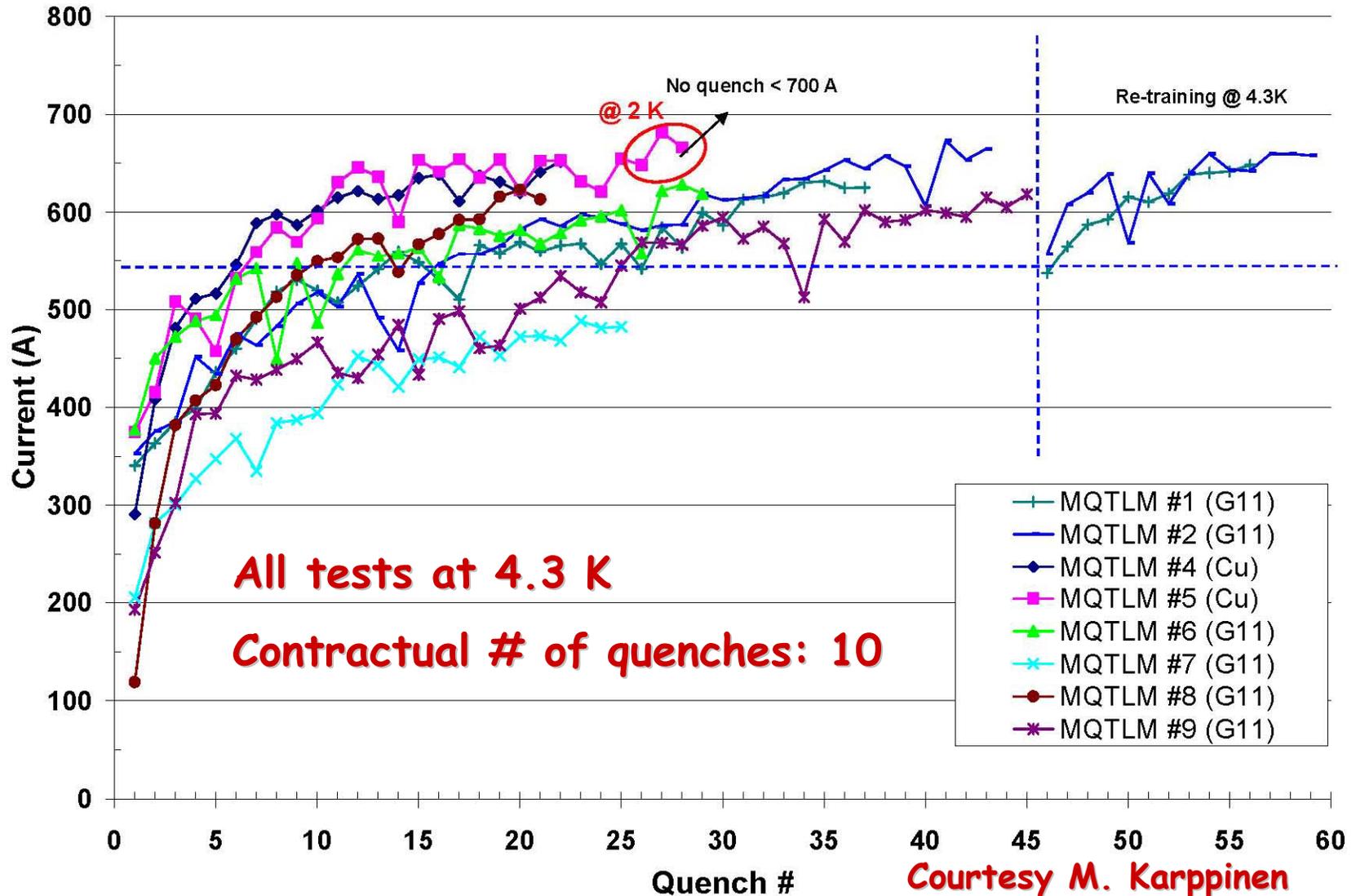
- **Nominal production rate:**
 - **CERN: 4 modules/month (already started)**
 - **ANSALDO: 6 modules/month (not started yet)**



- **ANSALDO: 5 magnets/month**

Measurement results for first modules - I

MQTLM Training



Measurement results for first modules - II

● Proposed strategy from AT:

● Training:

- To change the central post material. The positive impact on performance should be confirmed by measurements.
- To install "weak" elements produced so far in "safe" locations, i.e. determined in terms of required strength and flexibility for the LHC optics
- "Safe" locations should be defined by ABP.

● Delay:

- To reduce the number of quenches to shorten the test time.

Poor training is believed to be due to mechanical problems. Beam losses should not have an impact on this issue.

Optics considerations - I

- Experimental insertions require flexibility, hence safety margin in the strength of MQTLs
- **IR3 and IR7**: the optics is fixed and it cannot be changed -> they seem a good place to install **"weak"** MQTL
- In the analysis the optical configuration considered are
 - Injection
 - Injection at high energy (including change of phase advance in IR2)
 - Low-beta configuration, i.e. with all insertions squeezed

Optics considerations - II

IR3	Reserve (%)	IR7	Reserve (%)	Others	Reserve (%)
MQTLI.11L3	12.5	MQTLI.11L7	75.4		
MQTLI.10L3	74.5	MQTLI.10L7	2.1		
MQTLI.B9L3	5.0	MQTLI.B9L7	13.2		
MQTLI.A9L3	5.0	MQTLI.A9L7	13.2		
MQTLI.8L3	29.0	MQTLI.8L7	60.1	MQTLI.11R1	-17.5
MQTLI.7L3	2.2	MQTLI.7L7	-10.0	MQTLI.11L1	-11.7
MQTLH.F6L3	30.2	MQTLH.F6L7	14.3		
MQTLH.E6L3	30.2	MQTLH.E6L7	14.3	MQTLI.11L2	-14.9
MQTLH.D6L3	30.2	MQTLH.D6L7	14.3	MQTLI.11R2	-1.5
MQTLH.C6L3	30.2	MQTLH.C6L7	14.3		
MQTLH.B6L3	30.2	MQTLH.B6L7	14.3	MQTLI.11L4	46.3
MQTLH.A6L3	30.2	MQTLH.A6L7	14.3	MQTLI.11R4	80.5
MQTLH.A6R3	29.7	MQTLH.A6R7	11.9		
MQTLH.B6R3	29.7	MQTLH.B6R7	11.9	MQTLI.11L5	-11.7
MQTLH.C6R3	29.7	MQTLH.C6R7	11.9	MQTLI.11R5	-17.5
MQTLH.D6R3	29.7	MQTLH.D6R7	11.9		
MQTLH.E6R3	29.7	MQTLH.E6R7	11.9	MQTLI.11L6	73.4
MQTLH.F6R3	29.7	MQTLH.F6R7	11.9	MQTLI.11R6	69.0
MQTLI.7R3	-25.5	MQTLI.7R7	72.9		
MQTLI.8R3	37.1	MQTLI.8R7	16.4	MQTLI.11L8	39.4
MQTLI.A9R3	9.5	MQTLI.A9R7	56.5	MQTLI.11R8	-11.7
MQTLI.B9R3	9.5	MQTLI.B9R7	56.5		
MQTLI.10R3	30.3	MQTLI.10R7	-5.3	Nominal current 400 A for both MQTLH, MQTLI	
MQTLI.11R3	-2.9	MQTLI.11R7	75.3		

Field quality issues

- Partially analysed (see FQWG meeting 16/11/04)
 - Measurement results from a complete quadrupole should be available in few weeks
 - Experts believe there might be strong influence from one aperture to the other
 - A request to add field measurement with asymmetric powering was issued

Outlook

● Still missing:

● Fancy optical configurations:

- IR2/8: large β^*
- Alignment optics in IR1/5
- TOTEM optics in IR5
- Resonance-free lattices

● Beta-squeeze:

- IR8
- For MQTLI in Q11 (Right side of IP1 and IP5 for **beam 2**) the current is not monotonic vs. β^* .