TQS
Status and Plan

Helene Felice

TQS Tests

Magnet	Conductor	Coils	Island	Temperature	Test
TQS01a	MJR 54/61 (1900 A/mm2)	**5, 6, 7, 8**	Bronze	4.4 K	April 2006 LBNL
TQS01b	MJR 54/61	**14, 15,** 7, 8	Bronze	4.4 K	Nov, 2006 LBNL
TQS01c	MJR 54/61	5, 15, 7, 8	Bronze	4.4 K & 1.9 K	March 2007 FNAL
TQS02a	RRP 54/61 (2800 A/mm2)	**20, 21, 22, 23**	Titanium	4.4 K & 1.9 K	June 2007 FNAL
TQS02b	RRP 54/61	22, 23,**28,29**	Titanium	4.4 K & 1.9 K	March 2008 CERN
TQS02c	RRP 54/61	22, 23,28,20	Titanium	4.4 K & 1.9 K	June and Sept. 2008 CERN
TQS02d	RRP 54/61	22, 23,28,20	Titanium	4.4 K & 1.9 K	Dec. 2008 CERN
TQS03a	RRP 108/127	**30, 31, 32, 33**	Titanium	4.4 K & 1.9 K	Summer 2009 CERN

TQS02a, TQS02b and TQS02c Training

TQS02a (20, 21, 22, 23)
FNAL

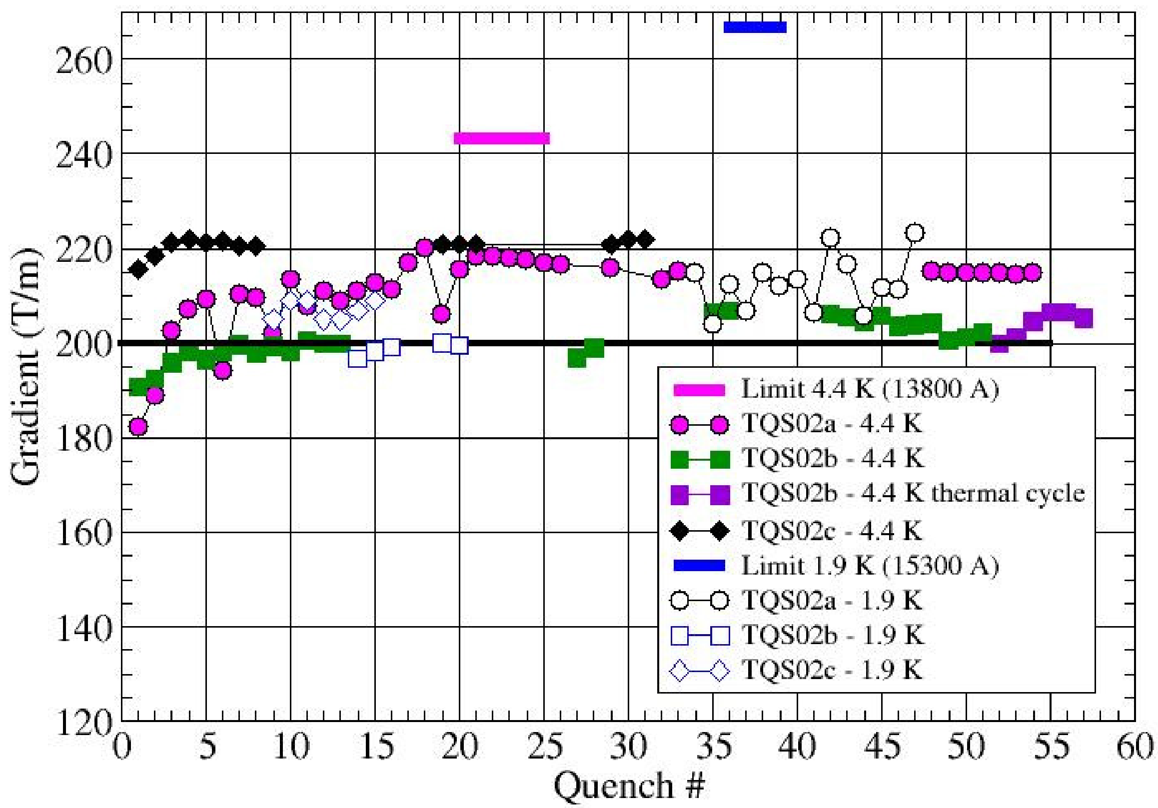
ε_θ from 1370 to 1600 $\mu\varepsilon$

ε_z from 1100 to 1500 $\mu\varepsilon$

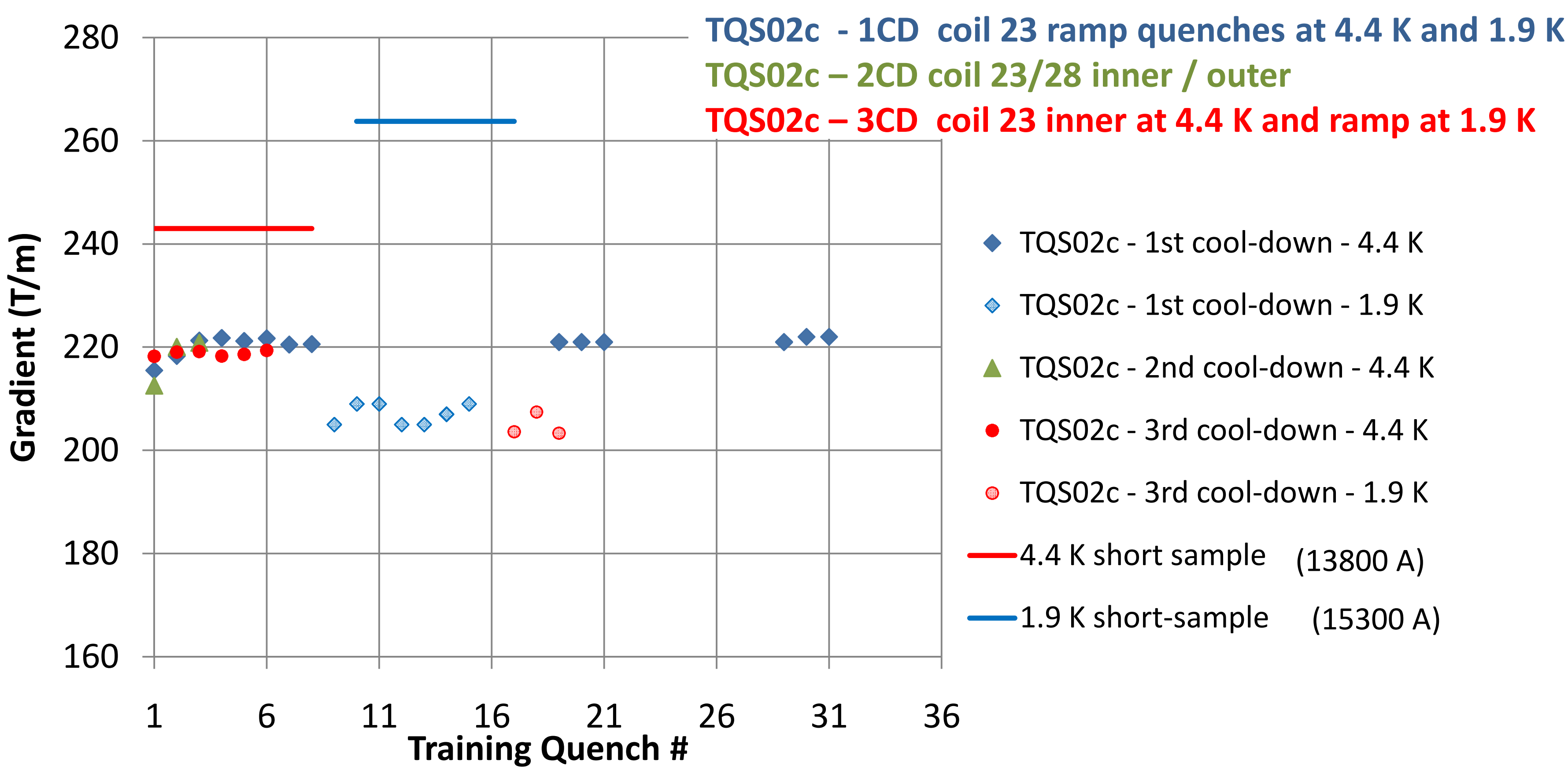
TQS02b (28, 29, 22, 23)
CERN
Limitation by coil 29

Coil 29 replaced by coil 20

TQS02c (28, 20, 22, 23)
CERN



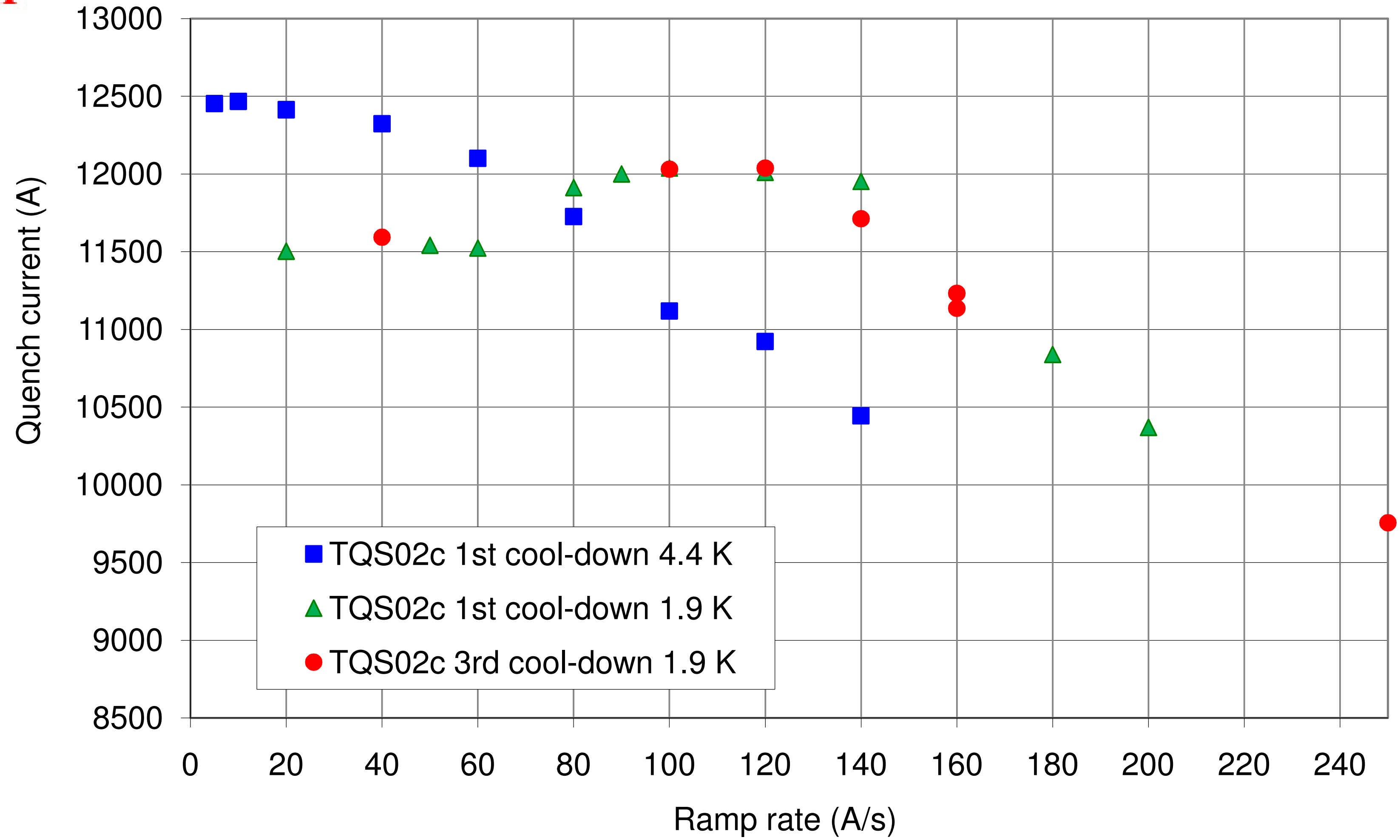
TQS02c Thermal Cycles – 4.4 K and 1.9 K Trainings



1.9 K tests confirm the instable behavior observed in TQS02a and b

Similar quench location at 4.4 K and 1.9 K

TQS02c - Ramp rate

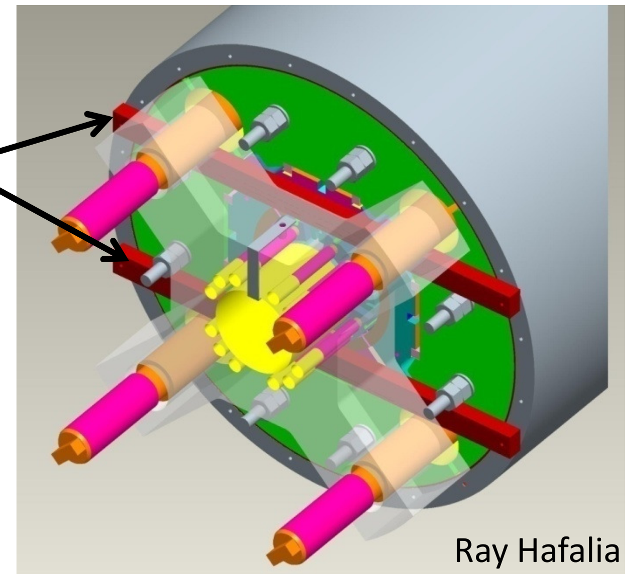


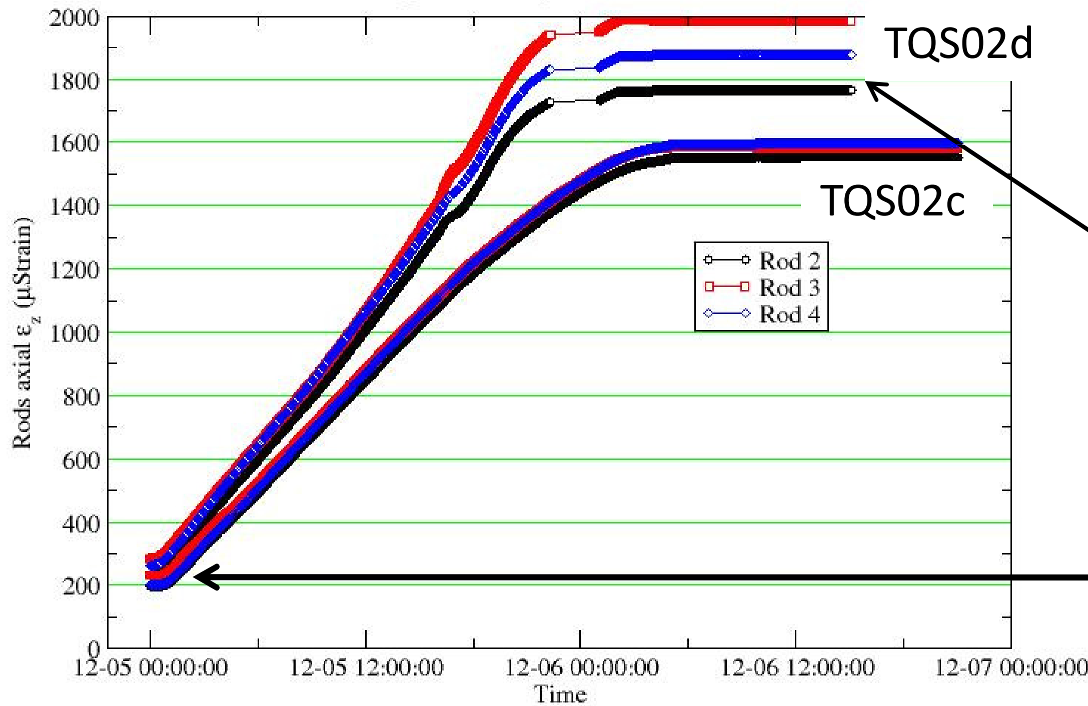
1.9 K ramp rate dependence inversion confirmed by TQS02c third cool-down

TQS02d

No complete disassembly
⇔Thermal cycle with reduced end loading
Juan Carlos Perez CERN
Ray Hafalia LBNL

Steel bars preventing the end plate from axially fully preloading the coils

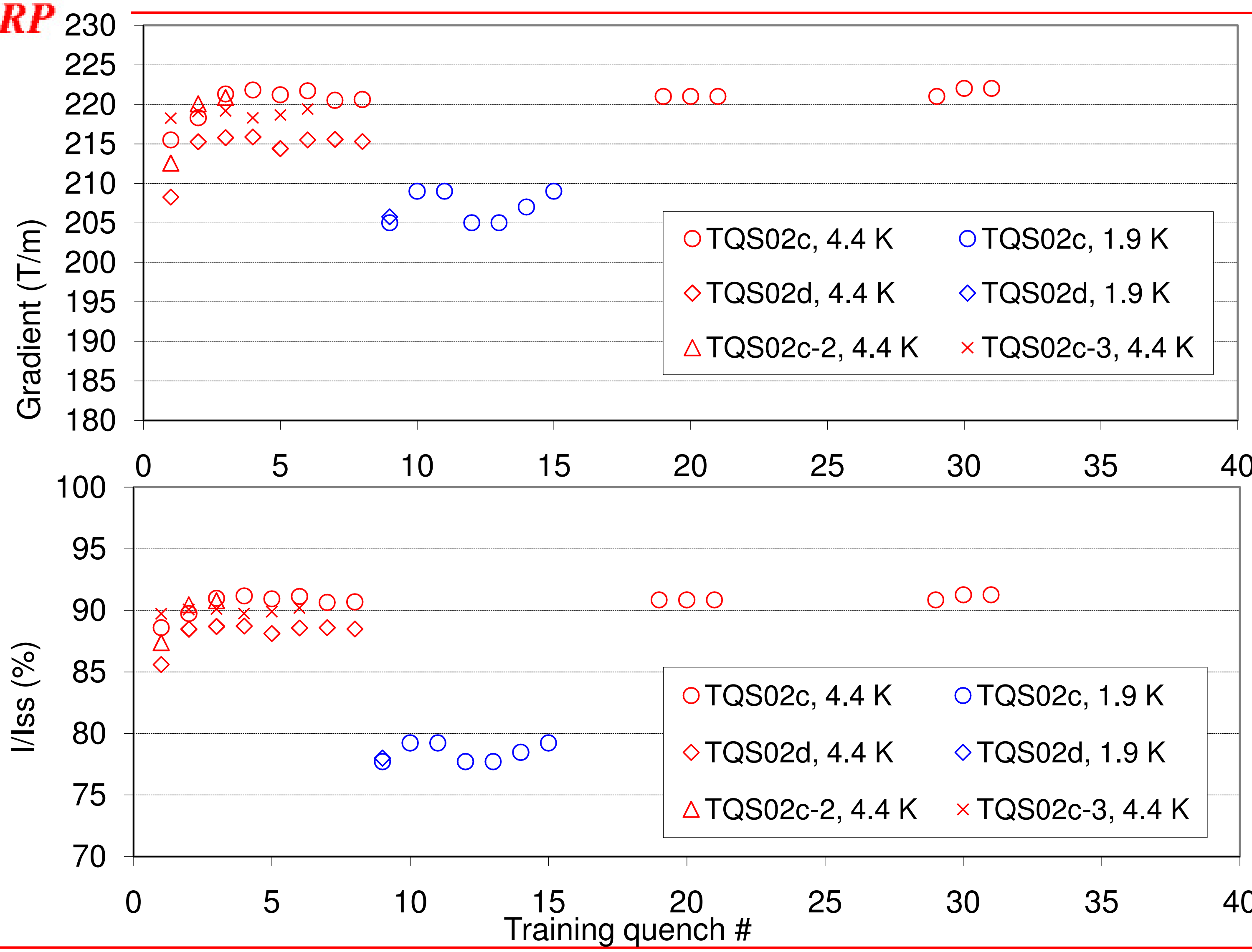




Increase of axial tension in the rods during cool-down
⇒plate pushing against a low thermal contraction part

Same room temperature axial loading

TQS02c – TQS02d training



Instability tests performed on TQS02c and TQS02d

Test plan prepared by B. Bordini (CERN), M. Bajko (CERN), S. Caspi and H. Felice
Based on B. Bordini's work on instabilities: modeling and strand measurement

Objectives: to understand the influence of the transport current distribution on magnet performances

Strand experiment performed on an RRP strand 54/61 by B. Bordini:

- Current hold at 1350 A at 4.3 K and 6 T ⟹ quench at 2.14 K
- Ramping at 2.14 K: quench current = 1050 A

- Current hold at 1200 A at 3.2 K and 6 T ⟹ to 1.9 K, quench when ramping
- Ramping at 1.9 K: quench current = 1000 A

- Current hold at 1250 A at 4.3 K and 6 T ⟹ to 1.9 K, quench when ramping

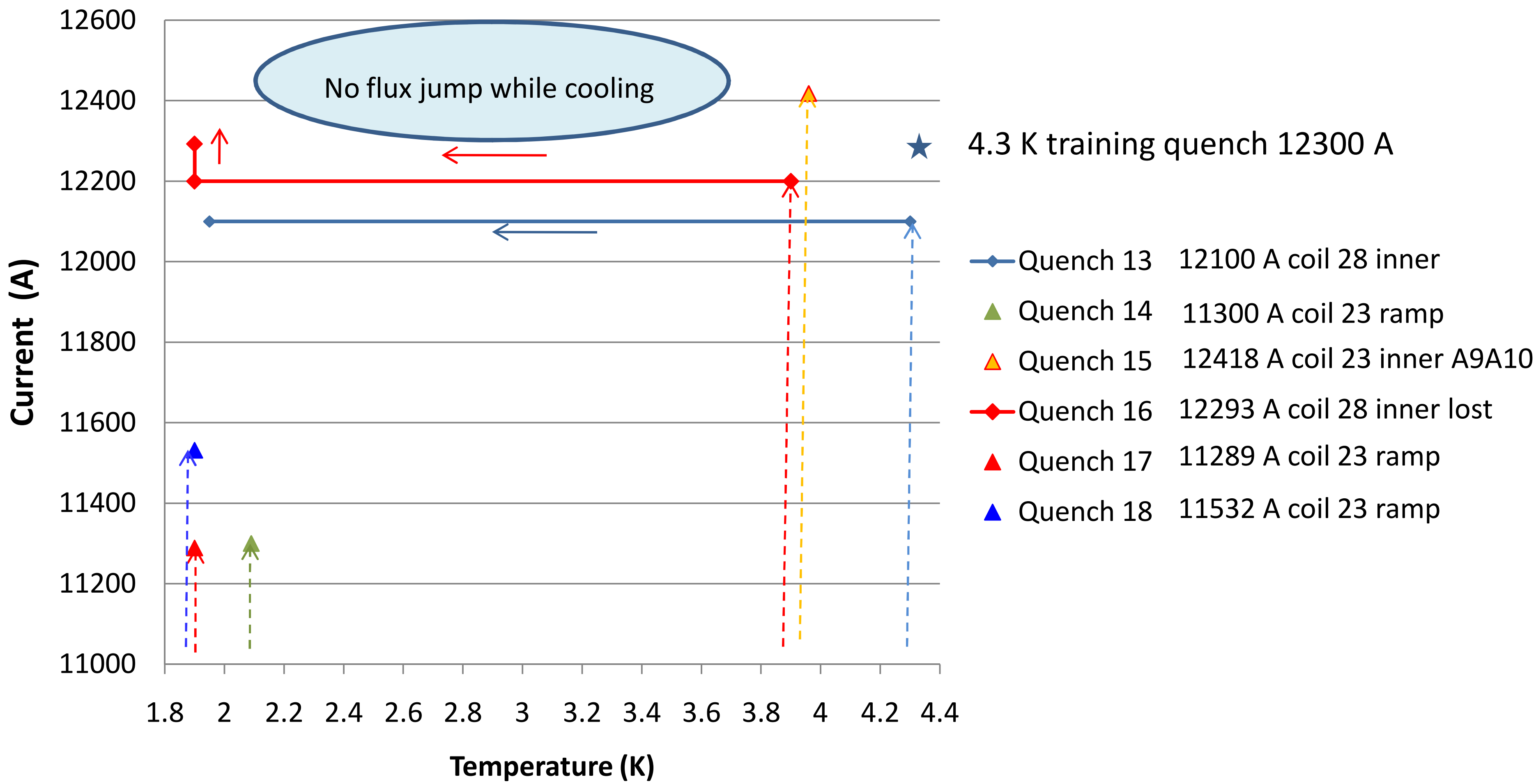
The objective was to perform the same test with the magnet

TQS02c - Cool-down with constant current

In collaboration with Bernardo Bordini and Marta Bajko

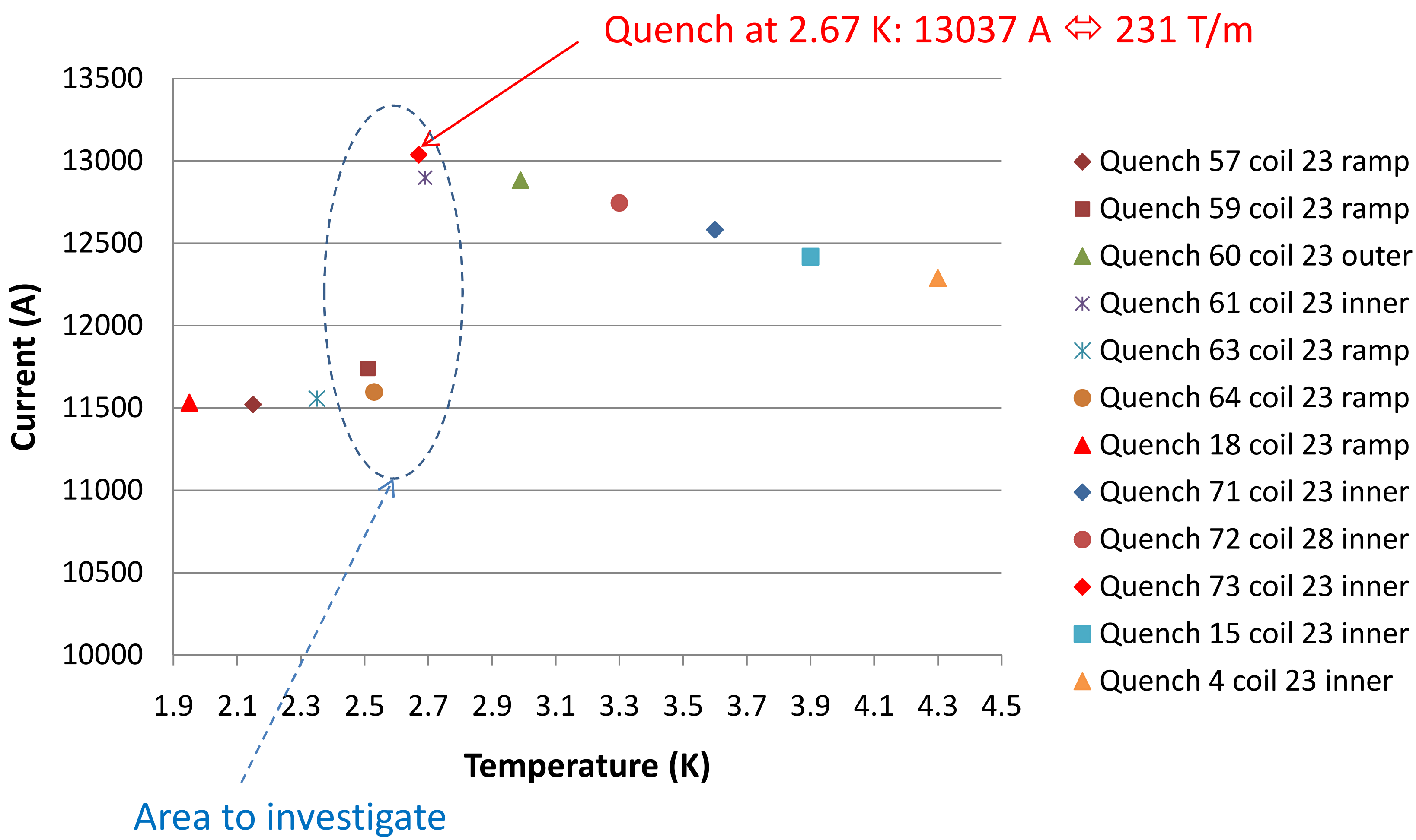
Principle of the experiment:

Ramping at the quench current minus 200 A ~ 12100A



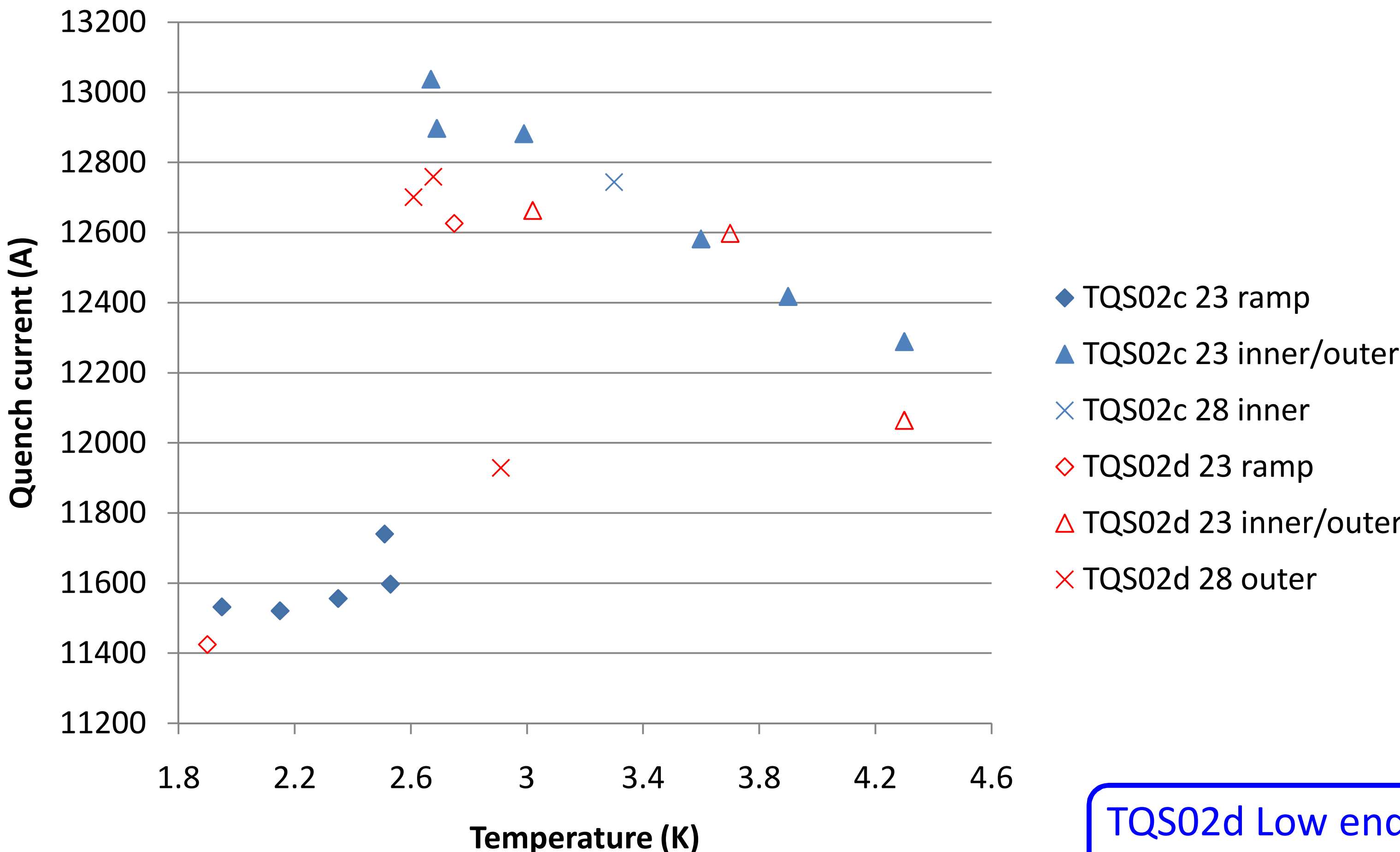
Temperature dependence of TQS02c

In collaboration with Bernardo Bordini and Marta Bajko



TQS02c and TQS02d Temperature dependence

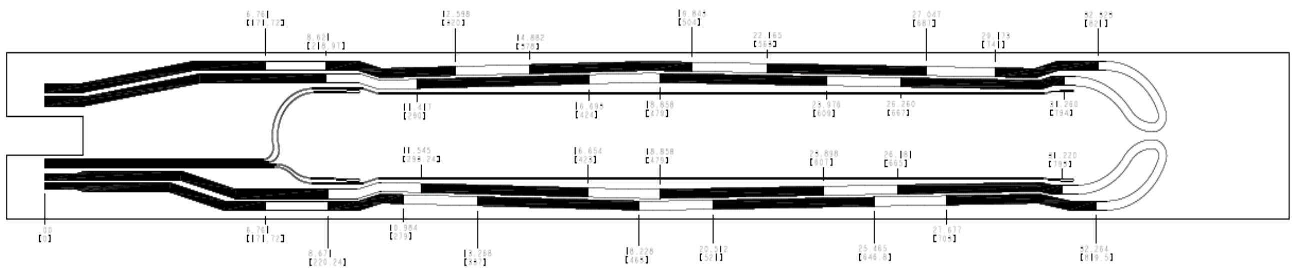
In collaboration with Bernardo Bordini and Marta Bajko



TQS02d Low end loading
Coil 28 possibly training

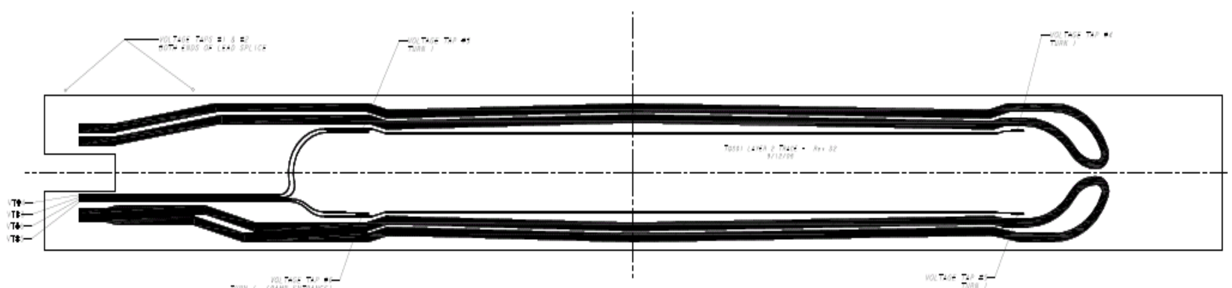
Protection Heater study: TQS02c

Coils: 20, 22, 23 with copper cladding => ~3.7 ohms per strip



Ray Hafalia

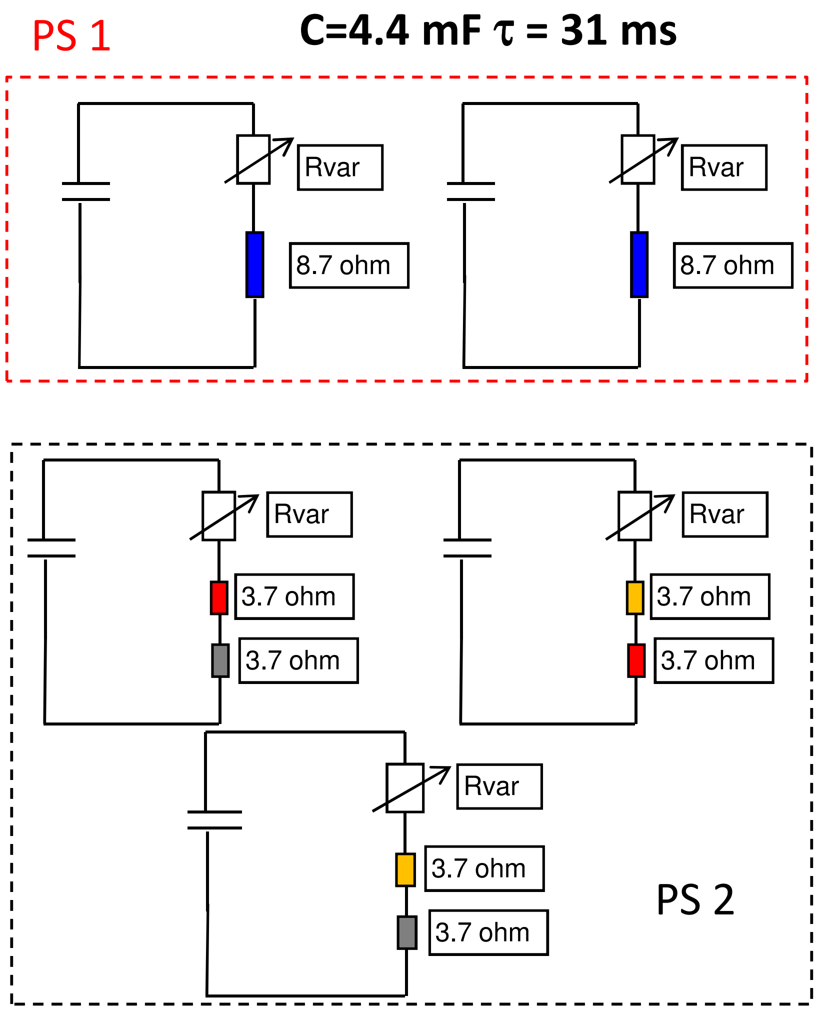
Coil: 28 without copper cladding => ~8.7 ohms per strip



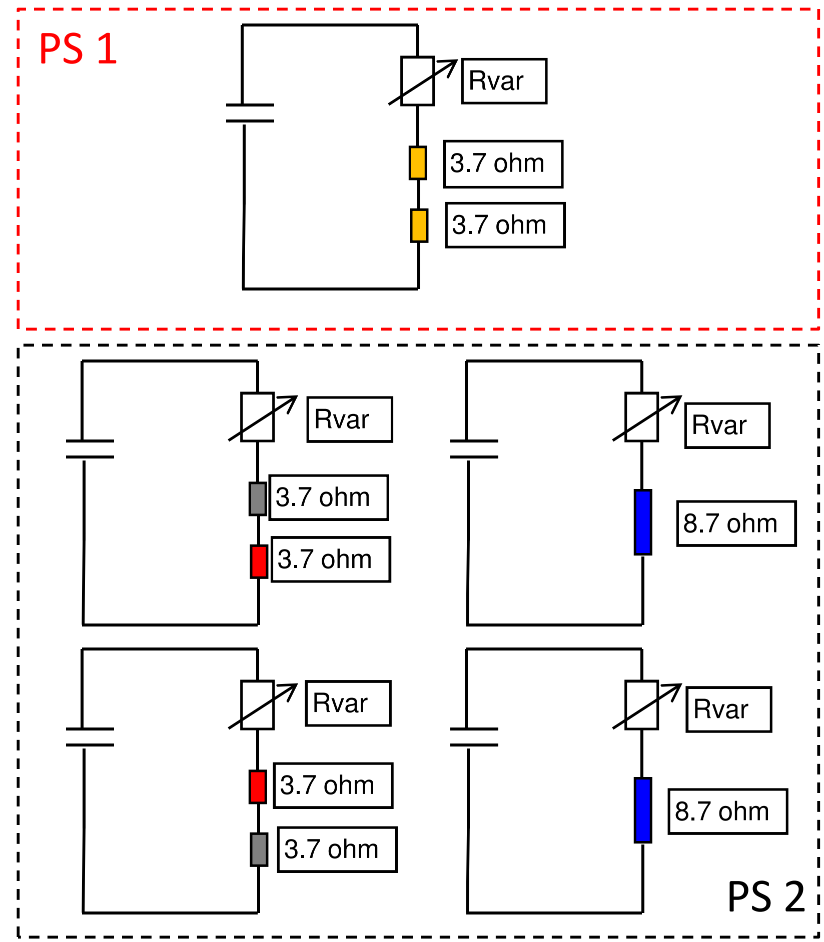
Ray Hafalia

TQS02c Protection Heater Powering

Test of coil 28 PH
C=4.4 mF τ = 31 ms

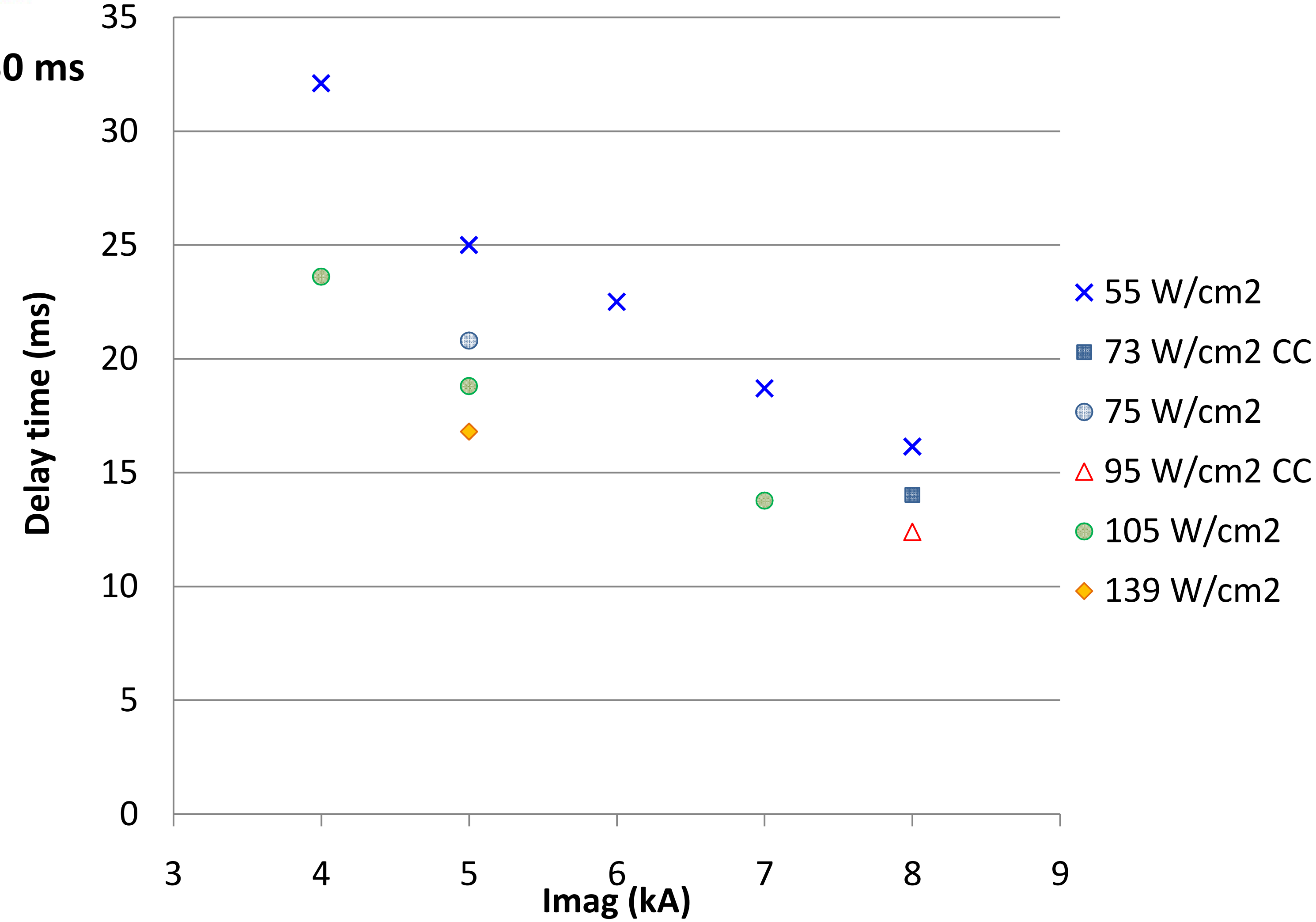


Test of coil 22 PH (CC)
C = 4.4 mF τ = 27 ms



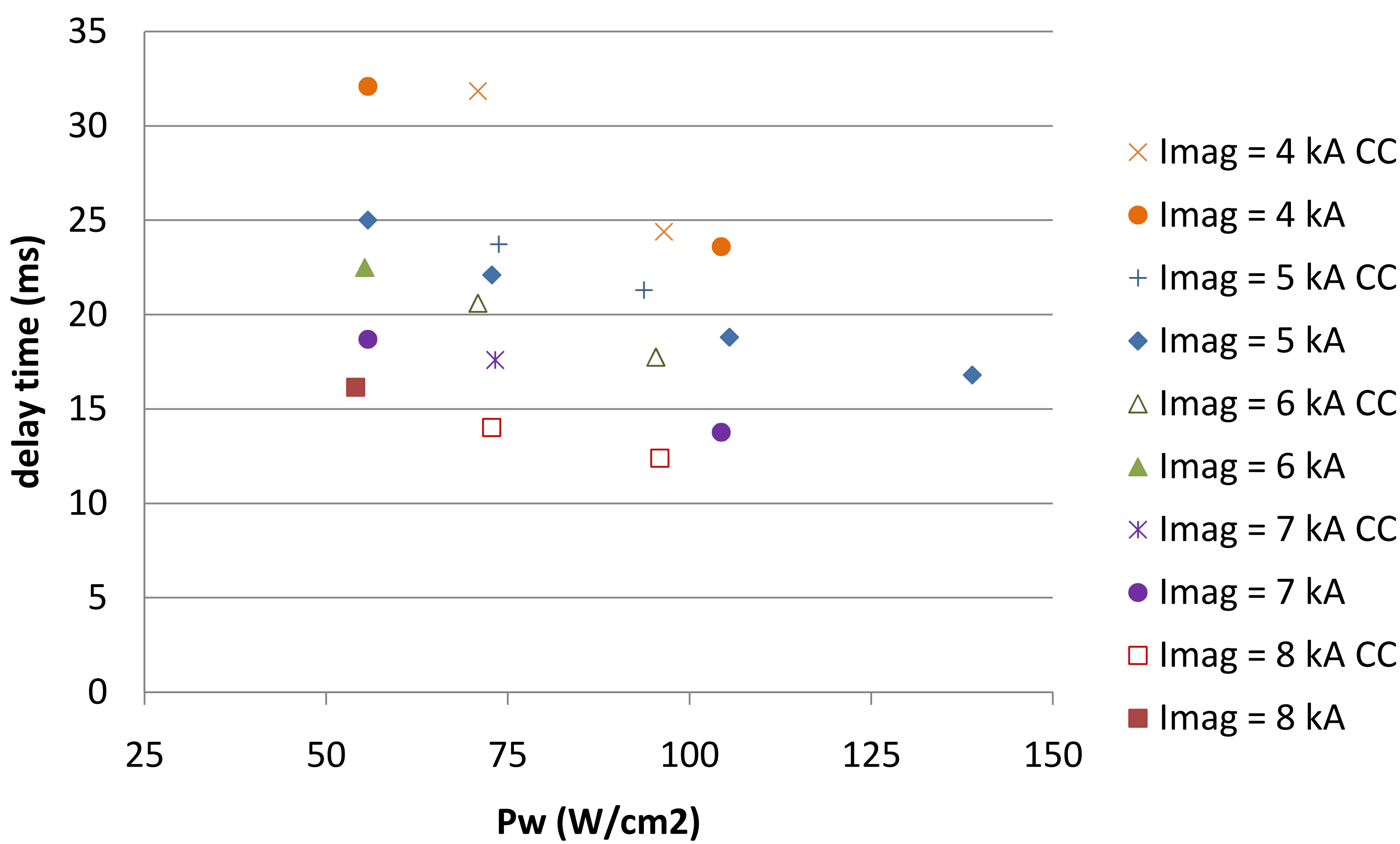
Delay time versus I magnet

τ ~ 30 ms



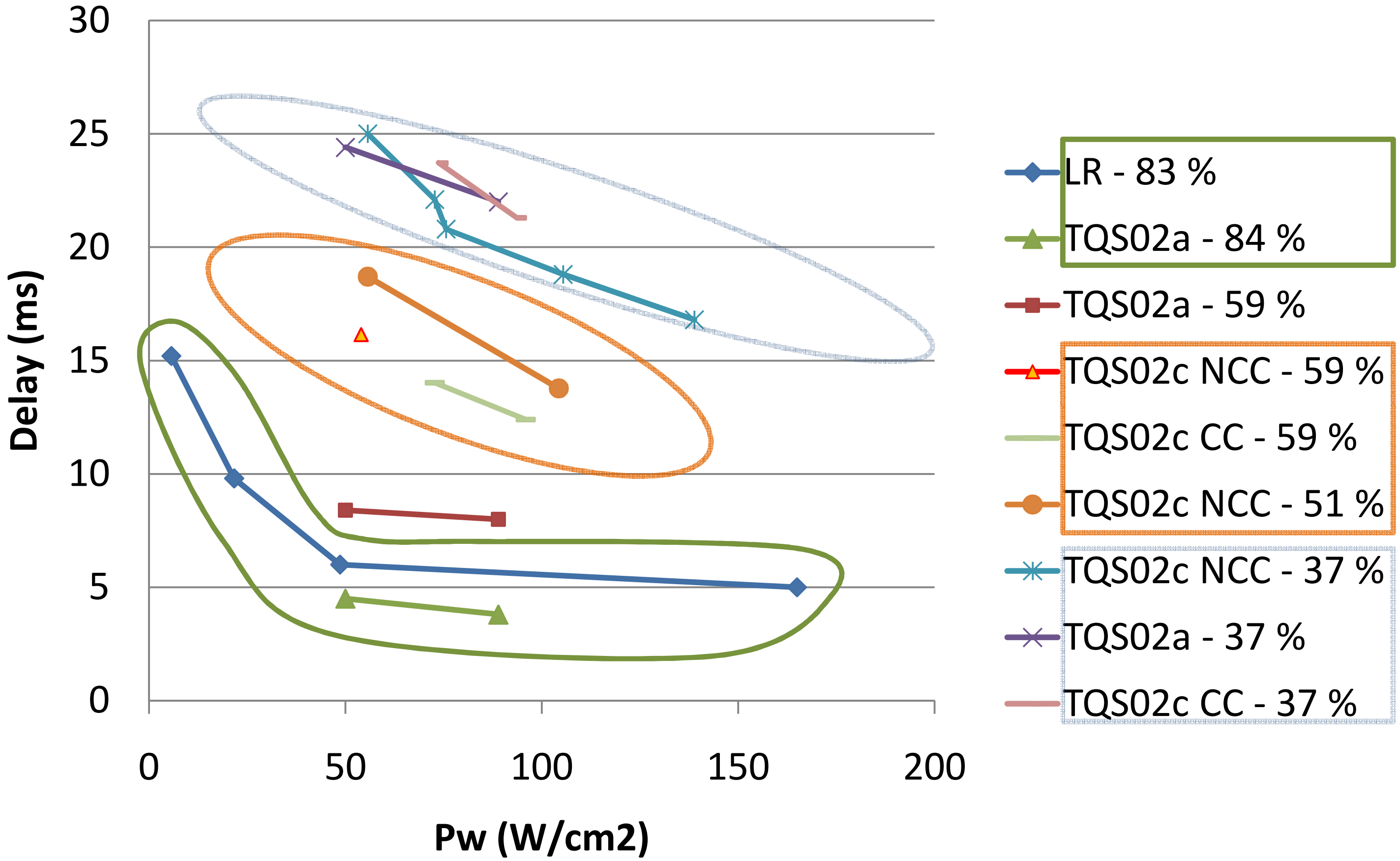
Delay time versus Power deposition

τ ~ 30 ms



Comparison with previous tests

τ ~ 30 ms



LARP

TQS03

Coils fabrication and instrumentation

⇒30 and 31 potted, being instrumented

⇒ 32 and 33 prepared for potting

⇒ 2 types of strain gages wiring

- ⇒ 30 and 31 with full bridges powered in series
- ⇒ 32 and 33 with each full bridge powered individually

TQS02d back from CERN and ready to be disassembled

Assembly

Shipping end of May

Test at CERN summer 2009

Test plan

Training / Ramp rate => 108/127 at 4.4 K ad 1.9 K

1.9 K tests => instability?

Protection heater tests