

Quench and Analysis of Transients Working Group

Kick-off meeting

Patricia Borges De Sousa, Gerard Willering, Mariusz Wozniak

QuAT WG, 18th Dec 2024



Agenda

- Mission statement
- Structure and topics
- List of identified speakers
- Organization
- Discussion



Mission statement

The **analysis of transient** events, such as **quenches**, ramp **losses**, and **cooling** dynamics, is essential for understanding and improving the **performance and reliability** of superconducting magnets. This working group addresses all aspects of transients, from **numerical modelling** and simulation to **experimental measurements** and **hardware development**. Topics include ramp-induced **losses**, **cooling** transients such as **cooldown** and **recovery** from a quench event, **quench diagnostics** and **detection**, and **protection** techniques. By **fostering collaboration** across multiple teams and laboratories, the group aims to **unify methodologies**, **validate models through measurements**, and **advance hardware solutions** to tackle transient phenomena effectively.

<https://hfm.web.cern.ch/hfm-working-groups>



Structure

I.D.	Scenario	Topic	Comments or key words
QuAT1.1	Ramp	Ramp loss calculations	AC loss calculations, conductor and magnet design impact
QuAT1.2		Screening currents	Transient effects in conductors or magnet structure when current is changing
QuAT1.3		Insulated coil ramp loss	What is the optimal way to ramp an insulated coils magnet given its design and available cooling
QuAT1.4		Non-insulated ramp loss	What is the optimal way to ramp an NI coils magnet given its design and available cooling
QuAT2.1	Cooling	Cooling arrangements and efficiency	Less helium, conduction cooling, magnet structure, reduced power consumption, sustainability
QuAT2.2		Cooldown and recovery time	Cool down and recovery times studies due to impact of cooling arrangements and magnet design
QuAT2.3		Ramp loss removal and strategies	Transient simulations with AC loss and cooling arrangements included
QuAT2.4		Synchrotron radiation loss removal	Transient simulations with Synchrotron radiation loss and cooling arrangements included
QuAT3.1	Quench	Spontaneous quenches	Voltage spikes, conductor movement, flux jumps
QuAT3.2		Inducing normal zone	Quench heaters, lasers, fast ramping, switching off cooling, E-CLIQ
QuAT3.3		Quench diagnostics	Voltage taps, quench antennas, fibre optics, acoustic emissions, temperature sensors, hall probes
QuAT3.4		Quench detection	Voltage taps, impedance change, temperature sensors, simulations
QuAT4.1	Protection	Quench Protection Simulations	Tools, Software, numerical methods, benchmarking
QuAT4.2		Quench Protection Techniques	New ideas, old ideas revisited, hardware

List of identified speakers and topics *

Date	Presenter	Topic
17.12.2024	Patricia Borges De Sousa, Gerard Willering, Mariusz Wozniak	Kick-off
t.b.c	Julien Dular	Multifilamentary strand AC loss simulations with CATI method
t.b.c	Erik Schnaubelt	HTS pancake simulations with 3D FE - insulated and NI coils
t.b.c	Mariusz Wozniak	HTS pancake coil conductor defects impact on quench detection
t.b.c	Tim Mulder	HTS pancake simulations with 2D FD - NI coils
t.b.c	Tim Mulder	HTS pancake simulations with 3D FD - insulated and NI coils
t.b.c	Davide Rinaldoni	HTS pancake simulations with 2D+1D FE - NI coils
t.b.c	Julien Dular	Conductor homogenization for FE quench simulations
t.b.c	Emmanuele Ravaioli	Energy Shift with Coupling - measurements and simulations
t.b.c	Emmanuele Ravaioli	Quench protection with CLIQ - measurements and simulations
t.b.c	Tim Mulder	E-CLIQ based quench protection - measurements and simulations
t.b.c	Tim Mulder	Capacitor-Discharge for quench protection of NI HTS coils
t.b.c	Mariusz Wozniak	Quench co-simulations of CCT magnets in 3D
t.b.c	Tim Mulder	Ramp optimisation for NI coils - example of Muon Collider magnet
t.b.c	Gerard Willering	AC loss measurement LTS+HTS
t.b.c	Gerard Willering	Measurements of splices and voltage of multitape cable
t.b.c	Ximo Gallud Cidoncha	Cooldown transient for cooling with 4.5 K gas He
t.b.c	Ximo Gallud Cidoncha	After quench cooldown for cooling with 4.5 K gas He
t.b.c	Patricia Borges De Sousa	Diffusivity in stacks of HTS tape



Organization

1. To begin with, we start with a sequence of presentations
2. Please contact the organisers with the topic and presenter availability if you would like to present on a topic that fits into the structure of QuAT WG
3. There will be only one presentation at a time
4. The focus is on discussion and collaboration rather than just communication of the work done
5. Ideas for deep dive sessions that are not presentations are welcome
6. Meetings on Tuesday at 4 pm every 2 weeks (or 3 weeks in holidays)
7. Attendance in person is strongly encouraged, the room to be in the invite
8. Link for Zoom will be available but is intended for colleagues who are not based at CERN



Discussion and feedback

Please let us know what are your thoughts about QuAT WG, in particular:

- Structure
- Topics
- Organization
- Anything else





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