Proposal of guidelines for presentations using quench test data (for discussion) and paper presentation

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Why do we need guidelines?

- Many people participated in quench tests, it is easy to forget someone
- They should be mentioned/acknowledged, and it is difficult to remember the whole list
- This guideline is a tool which will help in it
- Once the paper is published a reference to it will replace this guideline
- We also need to agree on names of various tests and used terminology to reduce confusion

Outlook

- Quench tests names
- Other suggested terminology
- Author lists
- Paper presentation
  - Structure
  - Plan
- Summary

Proposed names of quench tests (only above injection energies)

No	date	name	duration
1	2010-10-16	Dynamic orbit bump quench test	5 s
2	2010-11-01	Wire scanner quench test	10 ms
3	2013-02-15	Collimation quench test	5 s
4	2013-02-15	Q6 quench test	~ns
5	2013-02-15	ADT fast loss quench test	5 ms
6	2013-02-16	ADT steady state loss quench test	20 s

Names should be compact, reflect the idea behind the test and take into account *historical* nomenclature.

Other suggested terminology (I)

- **Quench**: Transition from the SC to the normal state (thermal runaway not required).
- **Quench recovery**: Transition back from normal to SC state. Avoid "quenchino".
- **Quench level**: **Minimum Quench Energy Density (MQED)** [J/cm^3] (fast losses), **Minimum Quench Power Density (MQPD)** [W/cm^3] (steady losses), in a given location at a given working point (current, temperature). Whenever possible, use MQED/MPED in favor of "quench level".
- **Temperature margin to quench** ($T_{cs} – T_o$) [K], **Margin on the loadline** [%], avoid energy/enthalpy margin – use above MQED, MQPD instead.
- **Deposited energy/power-density** [J/cm3], [W/cm3]: profile of the deposited energy density along the coil and across the coil.
- **Peak deposited energy/power-density** [J/cm3], [W/cm3]: maximum deposited energy/power density over the cross-section of the coil (often plotted as graph along the length).
- **Beam losses** [protons/s, protons]: protons lost from the beam for a given scenario or event. Avoid the use of the term "losses" in any other context.

Other suggested terminology (II)

- **BLM signal** [Gy/s]: BLM signal for a given beam loss; it is recommended to specify, especially in case of measured signals, which integration time has been used, eg.:
  - BLM signal in RS09 (1.3s) [Gy/s], or
  - BLM signal averaged over 1.3 s [Gy/s],
  - BLM signal integrated over 1.3 s [Gy].
- **BLM signal at quench** [Gy, Gy/s] or beam losses at quench [protons,protons/s]: BLM signal/beam losses corresponding to the time of quench (initial rise in resistive voltage – not the time when the QPS threshold is reached).
- **Assumed BLM quench level** [Gy, Gy/s]: assumed BLM signal corresponding to a quench for a given scenario.
- **BLM threshold** [Gy/s] - value of the BLM signal at which the beam dump signal is issued. Typically: BLM threshold = 0.3 * Assumed BLM quench level.
- **Do not use**: Enthalpy margin, quench enthalpy, energy margin, dose rate, losses (the term is too ambiguous as a physical quantity, only as "beam losses" [protons/s, protons]), quench limit, quenchino.

Authors:
dynamic orbit bump quench test

- Experiment: K. Dahlerup-Petersen,
  B. Dehning, A. Priebe, M. Sapinski,
  J. Steckert, A. Verweij, J. Wenninger
- Simulations: A. Priebe, V. Chetvertkova, FLUKA will come as well?
- QP3: B. Auchmann
- OP team: L. Ponce and GHH

Authors:
wire scanner quench test

- Experiment: K. Dahlerup-Petersen, B. Dehning, J. Emery, A. Guerrero, E.B. Holzer, E. Nebot, A. Verweij, M. Sapinski, J. Steckert, J. Wenninger
- Simulations: A. Lechner, F. Cerutti
- QP3: A. Verweij
- OP team: L. Normann, A. Macpherson

Authors: collimation quench test

- Experiment: R. Bruce, W. Hofle, E. Nebot, S. Raedelli, B. Salvachua, R. Schmidt , D. Valuch, D. Wollmann, M. Zerlauth
- Simulations: R. Bruce, S. Redaelli, B. Salvachua, F. Cerutti, E. Skordis
- QP3: A. Verweij
- OP team: J. Uythoven, L. Ponce, R. Suykerbuyk

Authors:
Q6 quench test

- Experiment: W. Bartmann, M. Bednarek,
  C. Bracco, R. Schmidt, A . Siemko,
  M. Solfaroli, D. Wollmann
- Simulations: A. Lechner, N. Shetty
- QP3: B. Auchmann
- OP team: J. Uythoven, L. Ponce, R. Suykerbuyk

Authors: ADT fast loss quench test

- Experiment: T. Baer, M. Bednarek, B. Dehning, E. Effinger, W. Hofle, J. Ludwin, E. Nebot, A. Priebe, B. Salvachua, M. Sapinski, R. Schmidt, A. Siemko, D. Valuch, D. Wollmann
- Special BI support: M. Ludwig, S. Bozygit
- Simulations: A. Lechner, N. Shetty, V. Chetvertkova, A. Priebe, D. Wollmann
- QP3: B. Auchmann
- OP team: J. Uythoven, G. Roy, R. Suykerbuyk

Authors:
ADT steady loss quench test

- Experiment: T. Baer, B. Dehning, E. Effinger, W. Hofle, A. Priebe, S. Redaelli, M. Sapinski, D. Valuch, S. Le Naour
- Simulations: A. Lechner, N. Shetty, V. Chetvertkova, A. Priebe, D. Wollmann
- QP3: B. Auchmann
- OP team: J. Uythoven, M. Pojer, M. Albert

Paper

Testing the beam-induced quench levels of LHC magnets during Run 1

B. Auchmann, T. Baer, M. Bednarek, G. Bellodi, C. Bracco, R. Bruce, F. Cerutti, V. Chetvertkova, B. Dehning, N. Shetty, W. Hofle, E. B. Holzer, A. Lechner, E. Nebot Del Busto, A. Priebe, S. Redaelli, B. Salvachua, M. Sapinski, R. Schmidt, E. Skordis, M. Solfaroli, D. Valuch, A. Verweij, J. Wenninger, D. Wollmann, M. Zerlauth,
CERN, Geneva, Switzerland
(Dated: October 17, 2013)

In the years 2009-2013 LHC has been operated with the top beam energies of 3.5 TeV and 4 TeV instead of the nominal 7 TeV, with corresponding reduced currents in the superconducting magnets. To date only seventeen beam-induced quenches have occurred, with eight of them during specially designed quench tests. During normal collider operation with stored beam there has not been a single beam induced quench. However, the conditions are expected to become much tougher after the long LHC shutdown, when the magnets will be working at near nominal currents in the presence of high energy and intensity beams. This paper summarizes the experiments done in order to investigate the (beam-induced) quench limits of the magnets at top beam energies. It describes the techniques used to generate controlled beam losses which were used to study the quench limits. Results are discussed along with their implication for LHC operation at nominal energy.

- A draft is in production
- Editors: Bernhard and Mariusz
- Some contributions already arrived

Paper structure (I)

1. Introduction (ok)
2. Quench levels (ok)
3. Methodology (missing: error discussion)
4. Fast losses (Chiara, Anton, Nikhil – Q6 quench test)
5. Millisecond losses
    - Wire scanner quench test (ok)
    - ADT fast loss quench test (Vera, Anton, Nikhil)

Paper structure (II)

- Steady-state losses
  - Collimation quench test (Belen, Francesco, Eleftherios)
  - Orbit bump quench test(s)
    - 2 chapters or one?
    - Still missing results (simulations)
    - Expected input from Agnieszka, Anton, Nikhil, Vera.
- Conclusions

Paper schedule proposal

- November 30th: 1st complete version to be circulated among all co-authors
- December 31th: final version
- Beginning of January: send to publication (Physics Review Special Topics: Accelerators and Beams - PRSTAB)

Summary

- Strong suggestion:
  let's use the same name for quench tests
- Strong suggestion:
  let's use the same terminology
- Suggestion:
  please use the authors mentioned;
  once the paper is published a reference to it is enough
- Paper:
  - 1st complete version by middle of November
  - Publication early next year.