Steady-state cable quench limits of the 11 T dipole

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Roadmap

Experimental measurements of steady-state heat extraction

Steady-state quench limits
- can be a conservative limit

by means of simulation codes:
Transient quench limits

Today’s presentation, using available data
Steady-state heat extraction

Measurements performed in 2012, for the Nb\textsubscript{3}Sn MQXF magnet

- **different** electrical insulation, w/o mica glass
- unreacted cable (effects on fiberglass thermal conductivity ?)

Different position in the cable, $T_{bath}$ heating configuration:

N.B. Heat transfer mechanisms in Nb\textsubscript{3}Sn coils are much simpler than in the current LHC Nb-Ti coils.
Steady-state cable quench limits

Calculated assuming the following hypotheses:

- nominal operating conditions
- available heat transfer data (MQXF, see previous slide)
- field map of the 11 T 1-in-1 demonstrator (around 10% optimistic)
Follow-up

Experimental measurements of steady-state heat extraction

To be performed using the 11 T (reacted) cable-type → next days

Steady-state quench limits
- can be a conservative limit

by means of simulation codes:

Transient quench limits
Conclusion

- Steady-state heat extraction determined for a Nb$_3$Sn cable, similar but not equal to the 11 T one

- With this assumption, cable quench limit around 110 mW/cm$^3$
  - steady-state (conservative, 20% ?)
  - uniform heat deposit over cable cross-section

- **Measurement** of the actual 11 T cable soon available
  → update of the quench limit calculation