

**Gero Pflanz**

# Carbon Fibre Reinforced Composites for the Tuning Structure of LHC RF Cavities

**Diploma Thesis**

**Bibliographic information published by the German National Library:**

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ISBN: 9783832400972

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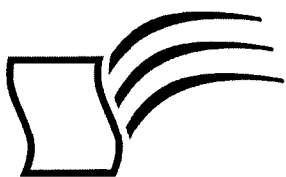


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Gero Pflanz

# **Carbon Fibre Reinforced Composites for the Tuning Structure of LHC RF Cavities**

**Diplomarbeit  
an der Technischen Universität Carolo-Wilhelmina zu Braunschweig  
Mai 1997 Abgabe**



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ID 97

Pflanz, Gero: Carbon Fibre Reinforced Composites for the Tuning Structure of LHC RF Cavities / Gero Pflanz - Hamburg: Diplomarbeiten Agentur, 1997

Zugl.: Braunschweig, Technische Universität, Diplom, 1997

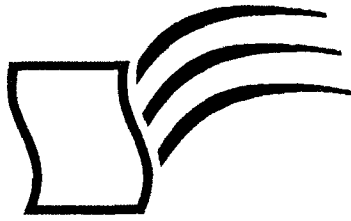
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### **Ihr Team der Diplomarbeiten Agentur**

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## Abstract

The suitability of different materials for the tuning structure of the LHC rf cavities is evaluated. The structure spanning the temperature interval from room to cryogenic is subjected to mechanical loading, and radiation.

A filament wound tube reinforced with high-strength carbon fibres is considered to be most appropriate.

Design calculations are performed using laminate theory. The safety margin for a cylindric filament wound tube under the given mechanical and thermal loading conditions is calculated for different winding angles.

The calculations indicate that the thermal load is causing shear and transverse stresses which are more critical than the stresses due to the mechanical load.

A fatigue test is performed with a prototype tube under thermal and mechanical working conditions as they are estimated for LHC.

Before and after the fatigue test, non-destructive testing methods (ultrasonic examination, microscopy, and geometry measurements) are employed to evaluate the material condition before and after the fatigue test.

All three non-destructive tests indicate that the prototype tube withstood the fatigue test damage free. No advice on fibre breakage, delaminations, or matrix micro-cracking has been found.



## Acknowledgements

I am grateful to my supervisor Prof. E. Steck from the Technical University of Braunschweig, who accepted and made it possible that this work could be done outside the university.

In fact, this work was carried out at the European Organization for Nuclear Research (CERN). I would like to thank CERN for giving me the opportunity to work at this impressive research centre and for the financial support I received as a Technical student.

I wish to express my gratitude to my supervisor at CERN, Dr. Volker Rödel, who supported me whenever he could and who was always ready to listen to my ideas and problems. I liked our discussions, where I learned a lot and I usually left his office in a better and more optimistic mood than I entered it.

The hospitality of the RF group of the SL division and the group leader Dr. D. Bousard made my stay at CERN not only a very interesting but also a very pleasant one.

I would like to say thank you for the support I had from many persons, groups and companies:

- CERN's 'Interlibrary Loan Group' provided me with almost any book or article I needed in a very short time.
- Dawn Hudson and Patricia Martucci took the time to proof-read my Diplomarbeit.
- Claude Hauviller and Michel Mathieu helped me with material data and had interesting ideas for the progress of my work, especially for the design calculations.
- Michel Kubly, Franck Gusti and Bernhard Girod prepared the tube samples in the workshop. They were very patient with my poor French in the beginning of my stay at CERN.

- Mr. Voirol from Stesalit AG Zulwill helped me with information on the design of filament-wound structures.
- The ultrasonic tests at the EMPA in Duebendorf were an important part of the non-destructive evaluation. Juerg Neuenschwander performed the ultrasonic tests.
- The non-destructive tests at CERN would not have been possible without the support of the metallurgy department of Mr. Bacher. I would also like to thank his colleague Dr. Stefano Sgobba for several informative talks and his support whenever a new idea had to be carried out.
- Mr. Fritz from the metallurgy group sacrificed his time explaining to me much about non-destructive testing and introducing me to the handling of different non-destructive test apparatus; in particular for ultrasonic investigation. I am grateful for his help and I enjoyed working with him.
- Mr. Escourrou and Mr. Tischhauser from the 'Cryogenics for Experiments and Testing Group' of LHC division, planned and set up the cryogenic test assembly, organised the provision of helium and many other things.
- I received much support from Donat Stellfeld who worked together with me during the fatigue test of the carbon tube. I had a good time working with him and I learned a lot.
- My friends Frank Gerigk and Oliver Hans had many helpful ideas.

In particular I would like to thank my family for its support throughout my studies and my girlfriend for her patience and understanding.

Geneva, May 1997



Gero Pflanz

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