

## CERN's Technology for Superconducting Cavities in European Industry

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### Abstract

For a period of more than ten years CERN has developed the technology to produce reliable superconducting cavities for LEP, first from bulk Niobium, later as Niobium sputter-coated Copper cavities. Cost effective production methods for the different fabrication steps have been chosen, tried and permanently improved. The actual state of CERN's technology will be presented as well as the performance of the LEP 4-cell cavities made by European Industry applying these methods

### INTRODUCTION

THE LEP energy upgrading program will be done with 192 superconducting cavities. The first 12 prototype cavities,

2 produced in industry, 10 by CERN, have been installed and operated in LEP since 1989. The continuation of the program will be done in a first step with 20 bulk Niobium cavities, followed by 160 sputter coated Nb/Cu cavities.

### THE BULK NIOBIUM CAVITIES

The 20 bulk Nb cavities ordered from industry, have been received and RF tested. Results are presented in table 1. A first module has been assembled and equipped for the accelerator. During the surface test the specified field levels could not be reached despite processing due to heavy electron loading. The reasons are now being analyzed while the module is kept in stand-by. The following bulk Niobium modules will be assembled in parallel, with installation into LEP beginning 1993.

Table 1 Performance data of accepted bulk Nb cavities

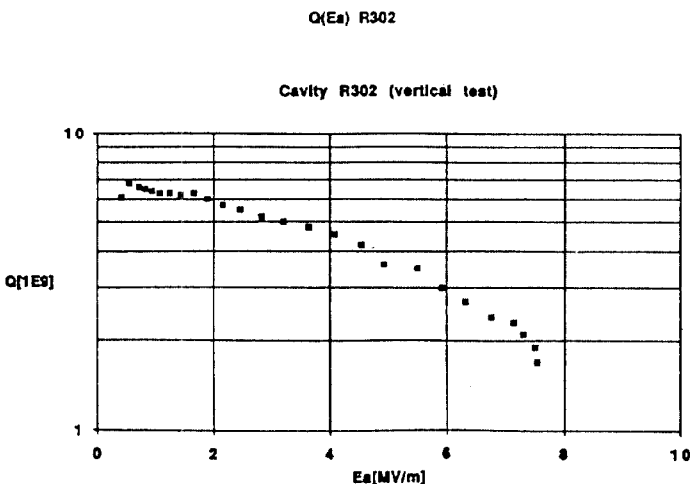
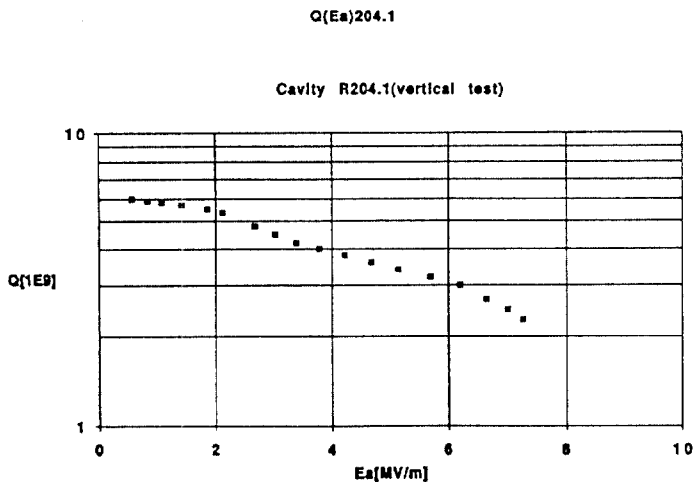
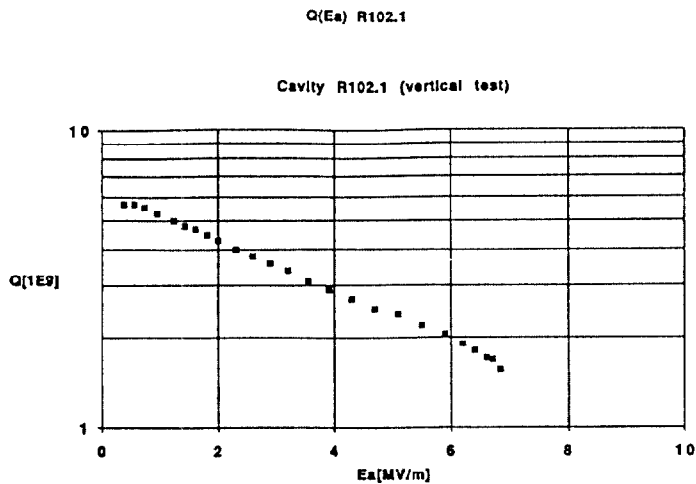
Date	#	Q[1E9]	Q)[1E9]	Ea,max
		(Ea->0)	(Ea=5 MV/m	[MV/m]
6-May-91	L17	4.3	3.4	7.05
28-Jun-91	L12	4.8	3.8	8.2
5-Jul-91	L11	5.2	5.2	6.9
12-Jul-91	L14	6	4	7.9
6-Aug-91	L13	6.2	4.5	7.6
3-Sep-91	R20	5.5	3.8	5.7
10-Sep-91	R22	5.2	3.7	7.5
13-Sep-91	L16	5.3	3.7	7.7
30-Sep-91	R21	4.6	3	7
18-Oct-91	R19	5.2	3.6	7.2
24-Oct-91	R24	4	3.3	7.4
6-Nov-91	R23	4.1	3.2	7.1
9-Dec-91	L15	4.5	3.4	6.3
26-Feb-92	R27	4.5	3	7.2
12-Mar-92	R29	4	3.1	7.1
19-Mar-92	R30	4.8	3.6	7.7

### THE SPUTTER COATED CAVITIES

To achieve the LEP energy upgrade, the main bunch of cavities will be of Nb/Cu sputter coated type and the order was shared by three European firms: ANSALDO (Italy), CERCA (France) and SIEMENS (Germany, former Interatom). The design field was asked to be 6 MV/m with a Q-value of  $4 \cdot 10^9$  at this field level.

During 1991 the technology transfer to industry was prepared for spinning, welding, chemistry, sputter coating and clean surface treatments. Since July 1991 the first prototypes arrived from industry and were measured vertically at CERN's test stands. Using this feedback, the transfer could be improved for finer details. This procedure has taken some time, none the less results have already been obtained which are not too far removed from the specifications. This can be

seen from the 3 following curves  $Q(E)$  which shows the best result obtained by each manufacturer. For one of the cavities (R204.1) the chemical treatment was done at CERN.



### THE 4-CAVITY MODULES

Once bare cavities fulfilling specification are produced regularly, assembly of the 4-cavity modules in industry can start (fig.1). The corresponding equipment as tuners, He-tanks, vacuum tanks, is already under production according to planning. Two separate contracts were adjudicated for the production of the power coupler and the higher order mode (HOM) couplers with SICN (France). The first phase of these two contracts is completed, i.e. 34 fixed power coupler have been received and 68 HOM couplers (type 5a). The second phase of the contract has just started with the reception of two prototypes of the CERN mobile power coupler and 3 prototypes of type 5c.

### CONCLUSION

All 20 bulk Niobium cavities have been received and are in the process of being measured and assembled to 4-cavity modules. The technology transfer for the Nb/Cu sputter coated cavities to European Industry has nearly been completed. We believe that the first cavities completely in accordance with the specifications will be produced in the near future, followed by the assembly of fully equipped 4-cavity modules.

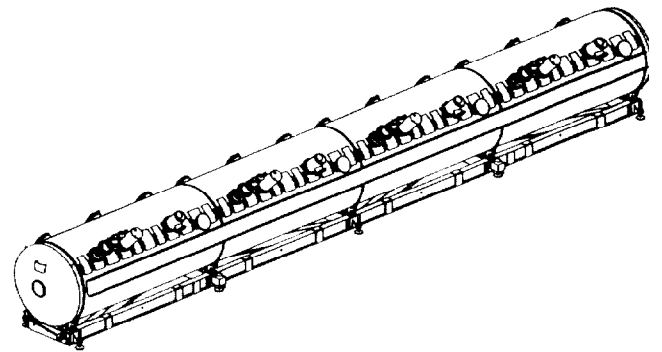


fig.1

### ACKNOWLEDGEMENT

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