THE SUPERCONDUCTING CAVITY DATABASE FOR THE TESLA TEST FACILITY

P.-D. Gall, A.Gössel, V.Gubarev, W.-D. Möller[#], M.Pekeler[*], DESY, Notkestr. 85, 22603 Hamburg, Germany

Abstract

Up to now over 60 superconducting 9-cell cavities have been tested at the TESLA Test Facility. 24 more 9-cell cavities are under production. In addition single cell, 4-cell, 5-cell and in near future also 3-cell cavities will be tested. A superconducting cavity database was developed, which keeps track of every preparation step and test result on the cavities. Interfaces were programmed in order to allow an easy and userfriendly view of the accumulated test results. In addition a direct recall of test results and preparation steps of cavities installed in the TTF Linac [1] was implemented.

1 INTRODUCTION

Up to now more than 60 superconducting 9-cell 1.3 GHz cavities, produced by different European companies, have been tested at the TESLA Test Facility (TTF) at DESY. 24 more 9-cell cavities are under production and will be delivered and tested in the near future. Moreover single cell, 3-cell, 4-cell and 5-cell superconducting cavities have been tested already or will be tested within the next sixteen months. At the end the 9-cell cavities are assembled and up to now installed as modules of 8 cavities in the TTF-Linac. We developed a relational database which keeps track of every preparation step and test result on the cavities. This database assures a reliable tool for checks, results and analyses by accessing the data from wherever in the TESLA Collaboration either by remote entry or via Internet.

2 DATABASE STRUCTURE

The cavity data are loaded into tables representing the main treatments and measurements for a cavity [2]:

- Production data provided by the manufacturers of the cavities and by the entrance control at DESY;
- Information about the cavity material;
- Results from cavity excentricity and frequency tuning measurements;
- Temperature, pressure and mass spectra for the heat treated cavities;
- Parameters and results from the buffered chemical polishing (BCP) and high pressure water rinsing (HPR) of the cavities;
- Information about the cavity assembly to the vertical and horizontal cryostats;
- Temperature and mass spectra from cooling down the cavities to 2K;
- RRR measurement results;
- Results from testing the cavities under CW and/or pulsed conditions;
- Data about testing and conditioning of input couplers with or without cavity;
- Information about the cavity assembly to the module and finally the module to the TTF-Linac.

These different cavity data are described in one or more tables which are related to a specific cavity by name of the cavity and a timestamp for its treatment or measurement. We use the ORACLE Relational Data Base Management System (RDBMS) which is accessible via SQL*NET from all the different computer platforms the TESLA Collaboration is using.

3 GRAPHICAL USER INTERFACE

A Graphical User Interface (GUI) for the TTF superconducting cavity database has been designed and created as one large multiform application based on the ORACLE Developer 2000 tools: FORMS, GRAPHICS, and REPORTS. It has been implemented [3] and permanently expanded over the years in interaction with the people involved in order to provide a userfriendly way for viewing and analyzing the accumulated data. The existing GUI has been migrated to the WEB via the ORACLE Developer Server. The "MAIN WINDOW" (Fig.1) that appears at the start time of a working session is the initial place to run all GUI components.

[#] E-mail: wolf-dietrich.moeller@desy.de

[*] Now at ACCEL Instruments GmbH, Friedrich-Ebert-Str.1, 51429 Bergisch-Gladbach, Germany

There are two ways to access the data:
- select historical status of the Linac and choose one of the available modules afterwards or
- select directly the cavity data by the cavity name.
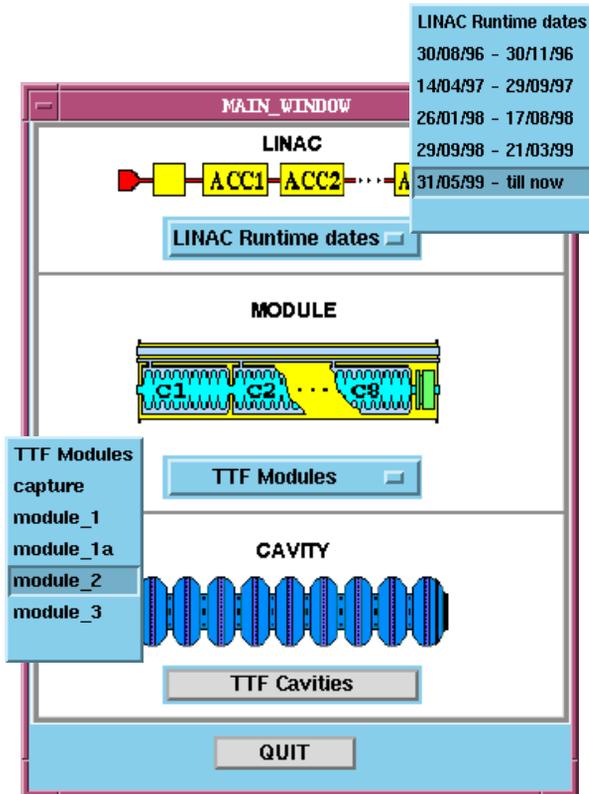
Fig.1: Start menu of the TTF SC Cavity Data Base Graphical User Interface (GUI).

3.1 LINAC and MODULE Part of the GUI

By selecting a linac runtime in the LINAC part of the "MAIN WINDOW" of the GUI (Fig.1) a window is opened showing schematically the linac assembly at this time (Fig. 2).
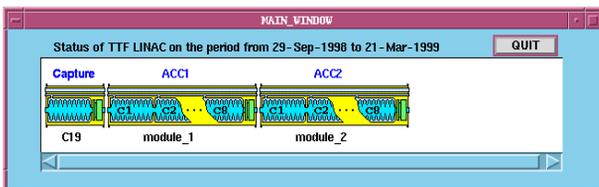

Fig.2: Linac assembly at a selected run time.

By clicking at a special module in this window or by selecting this module directly from the MODULE part of the "MAIN WINDOW" (Fig.1) a schematic view of the module displays the cavities, couplers and tuning mechanisms installed in this module (Fig.3).

A click to a selected cavity in the module points to the cavity-related part of the GUI (Fig.5) discussed below. In

addition a direct recall of test results and preparation steps of the cavities installed in the module is implemented. For example in the table of Fig.4 the CW and pulsed test results for some cavities installed in a module are displayed. For the selected cavity the curve compares the cryo losses and the normalized X-rays for different test methodes.
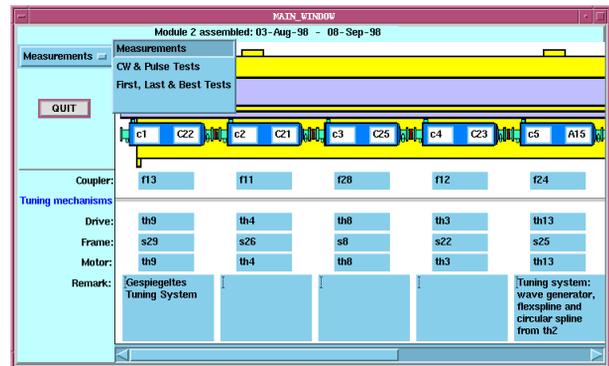
Fig.3: Composition of a selected module out of cavities, couplers and tuning systems.
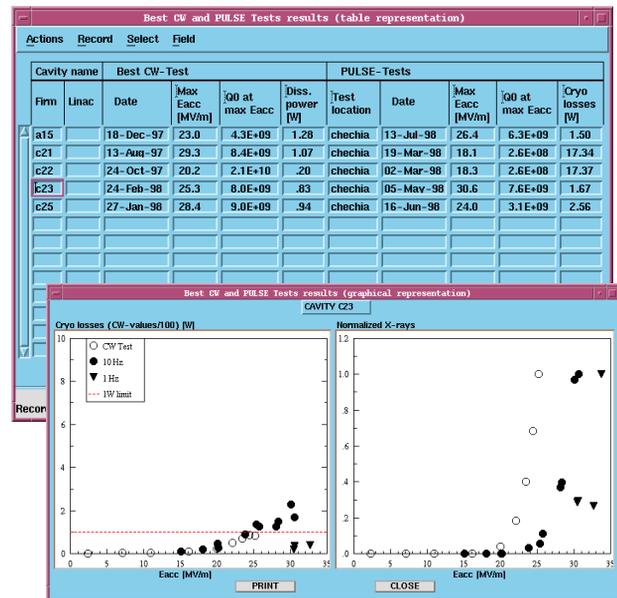

Fig.4: Comparison of CW and pulse test results for cavities installed in module 2 in table and graphical representation from "MEASUREMENTS" in Fig.3.

3.2 CAVITY Part of the GUI

By pressing the button "TTF Cavities" (Fig.1) the start window for the cavity-related part of the GUI is opened providing some "Specific Cavity Information" and information about the most important "CHECKS", "SUMMARIES", "PROPERTIES", "LOGISTICS" and "Results of RF-Tests" of the superconducting cavities (Fig.5).
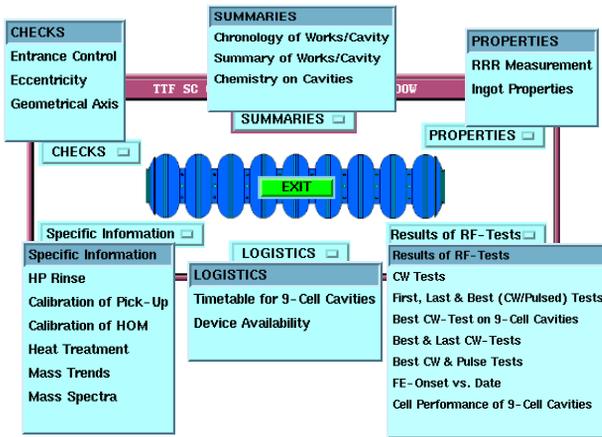
Fig.5: Start window of the cavity-related part of the GUI. By pressing the appropriate buttons windows are opened which contain for instance information as displayed in Figs.6 - 12.
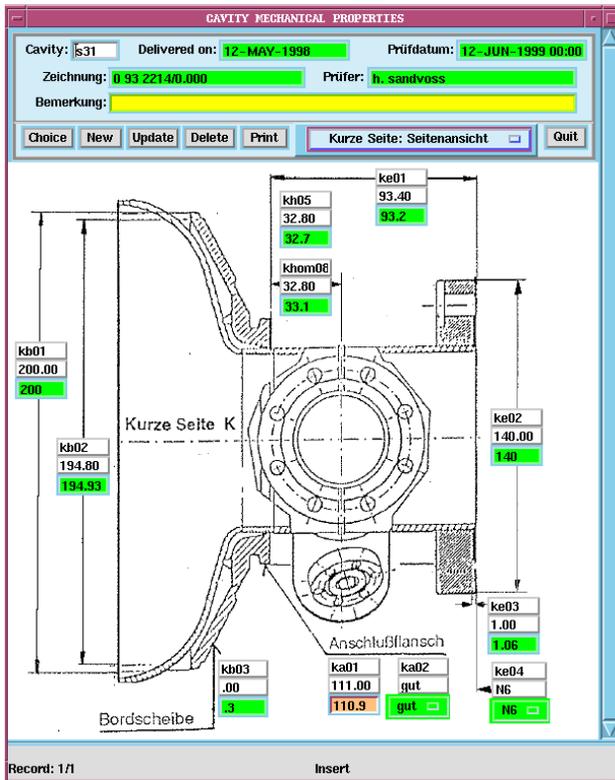

Fig.6: Information on entrance control of the mechanical properties of cavities from "CHECKS".

In this form it is easy to compare the designed and measured data of the mechanical geometry. The background color is red if the measured values are out of tolerance, otherwise green.
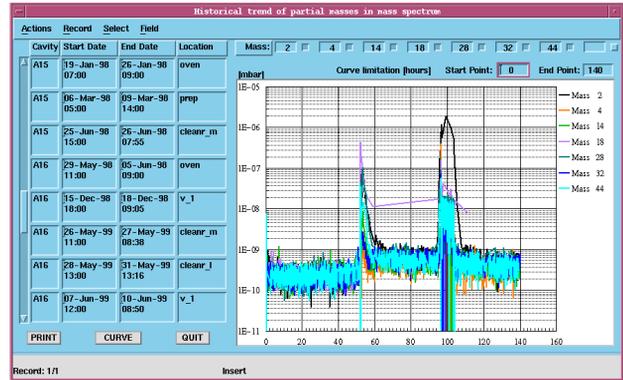

Fig.7: Historical trend of partial masses in mass spectrum during heat treatment of the cavity from "SPECIFIC INFORMATION". The time interval and the partial masses can be selected by the operator.
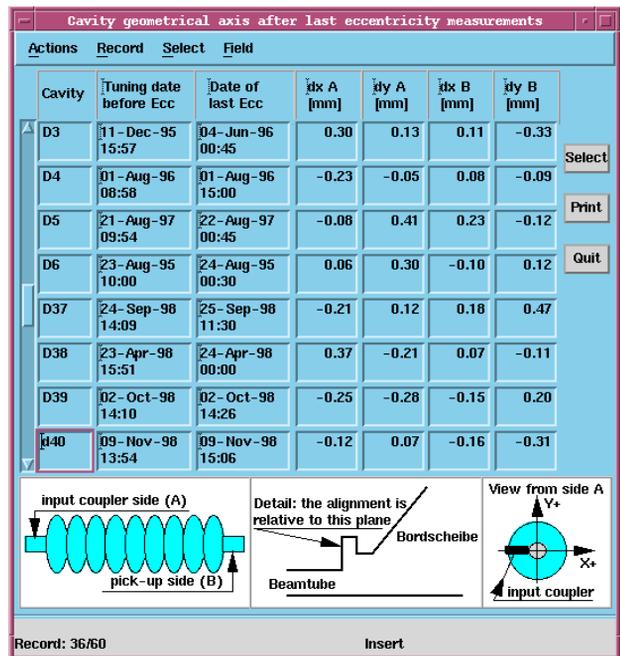
Fig.8: Reconstruction of geometrical cavity axis based on excentricity measurements from "CHECKS".
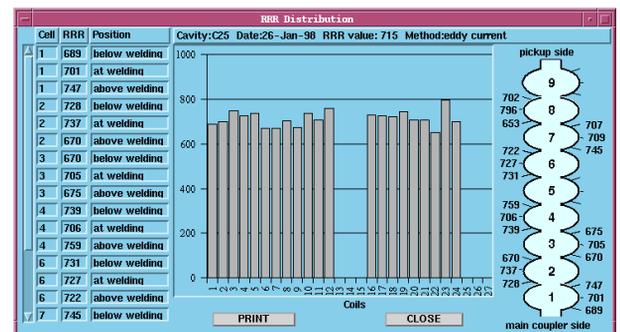
Fig.9: Result of RRR measurements on cavity from "PROPERTIES".

This form shows that RRR measurements are usually perfomed below, above, and on the weld of each cavity cell.

Fig.10: Timetable for 9-cell cavities momentarily under work with detailed information from "LOGISTICS".

The timetable above shows only the last handling information about the status of the cavities under work. If you want more detailed information about the whole cavity processing history, you get it by selecting the cavity name.


Fig.11: CW test results for all cavities with selected Q-vs.-Eacc curves from "RESULTS OF RF-TESTS".

In these windows individual power rises from different cavities are compared. By pressing, for example, the button "Multiple Q(E)" selected data are shown in a single plot.

Fig.12: Cell performance of 9-cell cavities in CW tests from "RESULTS OF RF-TESTS".

4 DATA COLLECTION

Most data collected from different preparation steps and measurements using different host computers are sent immediately by the operators as ASCII files to a central VAX/VMS computer. There they are catalogued for bookkeeping and loaded to the database structure. This guarantees an up-to-date version of the most important data within a day. Other data - like the timetables of the momentarily processed cavities and of the availabilty of important preparation and measurement devices - are normally updated only once a week.

5 FUTURE DEVELOPMENT

In the future the database structure and GUI will be modified by extending the linac and module parts including, for example, the results about coupler conditioning.

A subsystem based on ORACLE Developer 2000 will be created to load most data automatically into the TTF superconducting cavity database.

6 REFERENCES

[1] D.A. Edwards: TESLA TEST FACILITY LINAC - Design Report, TESLA 95-1, 1995

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[3] P.-D. Gall at al.: "Superconducting cavity database for TTF", Proceeding of the eighth workshop on RF superconductivity, Abano Terme, Italy, 1997, Vol. III, p.440