A DATABASE FOR SUPERCONDUCTING CAVITIES FOR THE TESLA TEST FACILITY

P.D. Gall, A. Goessel, V. Gubarev, DESY, Notkestr. 85, 22603 Hamburg, Germany

Abstract

The most important data about the superconducting cavities and RF couplers for the TESLA Test Facility TTF are stored in a relational database. The data are mainly due to visual, mechanical and electrical entrance checks of the cavities, their chemical treatments and the results of their RF measurements at 2 K. Further data concern the testing and conditioning of the RF couplers with and without cavity. Up to now data from more than 100 superconducting 9-cell cavities, about 40 single cell, some 2-, 3-, 5- and 7-cell cavities and about 50 RF couplers have been collected in the database. 30 more 9-cell cavities are expected in the near future. The database is dynamically accessible for everybody via an extensive graphical WEB interface, based on ORACLE products, which enables the users to select and analyse the stored data easily from everywhere.

INTRODUCTION

Up to now more than 100 superconducting 9-cell 1.3 GHz cavities, produced by different European companies, have been tested at the TESLA Test Facility (TTF) at DESY. 30 more 9-cell cavities are under production and will be delivered and tested in the near future. Finally most of the cavities are assembled and installed as modules of 8 cavities in the TTF Linac [1]. In an R&D program about 40 single cell and some 2-cell, 3-cell, 4-cell, 5-cell and 7-cell superconducting cavities have been tested in order to optimise the production and preparation techniques for the cavities. Selected data are collected into a relational database to keep track of every preparation step and test result of the cavities. This database assures a reliable tool for comparisons and analyses by accessing the data from everywhere via a graphical WEB interface based on ORACLE products: *http://tesla.desy.de/~oracle/ttf_gui_home.htm.*

DATABASE STRUCTURE

The cavity data are loaded into more than 100 tables representing for each cavity the essential checks, treatments and measurements [2]:

- Production data provided by the manufacturers of the cavities and by the acception control at DESY;
- Essential properties of the cavity material;
- Results from cavity eccentricity and frequency tuning (field flatness) measurements;
- Temperatures, pressures and mass spectra for the heat treated cavities;
- Parameters and results from degreasing, buffered chemical polishing (BCP) or electropolishing (EP), and high pressure water rinsing (HPR) of the cavities;
- Information about the cavity assembly to the vertical and horizontal test stands;
- Temperatures and mass spectra from cooling down the cavities to 2 K;
- RRR measurement results;
- Results from testing the cavities under cw and/or pulsed conditions;
- Data about testing and conditioning of input couplers with and without cavity;
- Information about the cavity assembly to the modules and finally the modules to the TTF-Linac.

These different cavity data are described in one or more tables which are related to a specific cavity by the cavity name and a timestamp for its treatment or measurement. We use the ORACLE Relational Data Base Management System (RDBMS) which is accessible via the graphical user interface through the WEB. ORACLE uses SQL, the Structured Query Language, and allows complex queries and table crossings.

DATA COLLECTION

The data collected from different preparation steps and measurements using different host computers or the Engineering Data Management System (EDMS) Metaphase from e!Vista are either loaded directly to the database through ORACLE FORMS or by using embedded SQL (Pro*FORTRAN) to handle ASCII files. The ASCII files are either generated directly or via a special command language to parse and extract data from user defined text files (Fig. 1). The most important data are updated within a day, whereas statistics data, like the timetable of processed cavities and the availability of relevant preparation and measurement devices, are usually updated only once a week.

DATA HANDLING

Views

For an easier access to the data collected in the database we created *VIEWS* which are logical tables based on one ore more tables of the database. Some views combine data from tables corresponding to one cavity preparation or measurement type, e.g. the view gathering data about the tests under pulsed conditions (3 tables involved). On the other hand complex *SUMMARY* views collect data from tables describing different cavity preparation and/or measurement procedures. The view *Best_Test_Results*, for example, combines the data about the treatment and measurement history of a cavity (10 different treatments and measurements from 20 database tables). The views allow an easy access to complex data queries. The queries

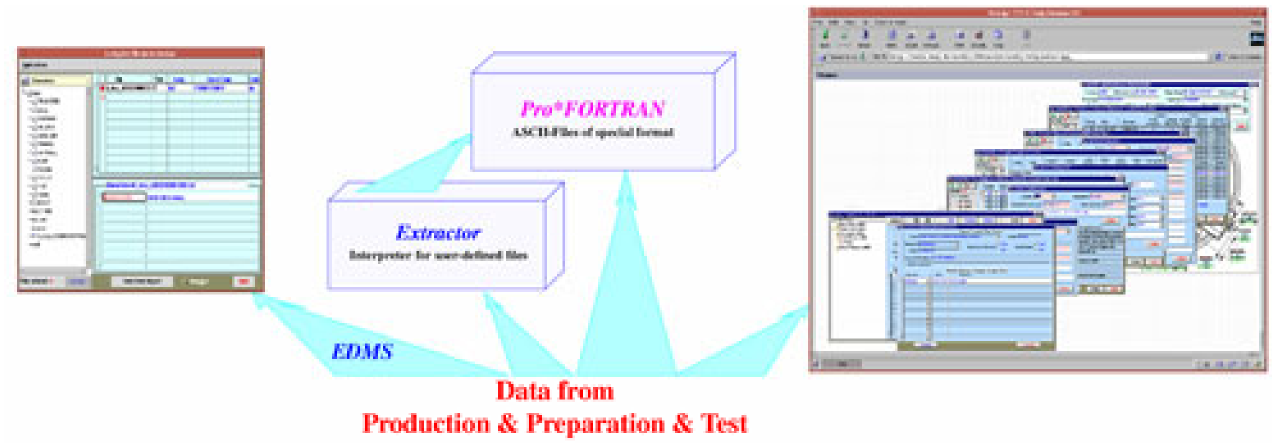

Figure 1: Schematic structure of the data loading.

may be handled by native SQL scripts or by client programs like MS EXCEL using ODBC (Open Database Connectivity) drivers.

Graphical User Interface

A Graphical User Interface (GUI) to the database for the superconducting cavities for TTF has been implemented [3] as one large multiform application based on the ORACLE Developer 6i tools FORMS and GRAPHICS. It has been permantly expanded over the years in interaction with the people involved in order to provide a user-friendly way for viewing and analysing the accumulated data in the client-server mode as well as in the WEB (Fig. 2).

The GUI is entirely based on about 50 views. It represents the data either in such FORMS where the results of just one cavity can be selected from a list of cavities, e.g. in *Summary of Works/Cavity* (Fig. 3), or in multiframe FORMS where the data of all cavities or a selected group of cavities may be compared, e.g. in *Summary of Last RF Tests* (Fig. 4).

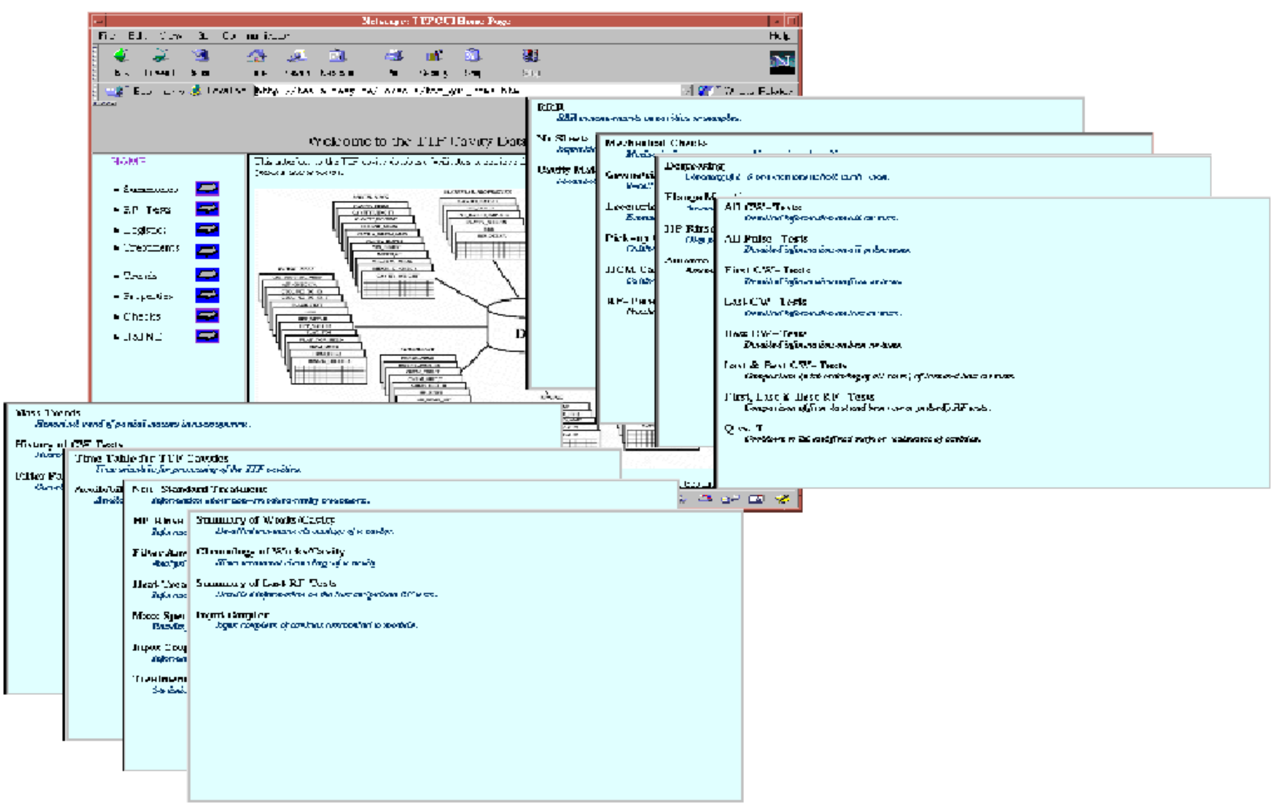

Figure 2: Start page of the GUI to the database for the TTF cavities.

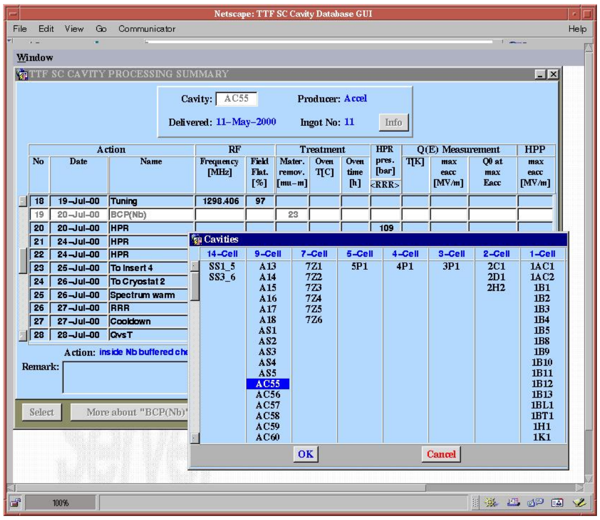

Figure 3: Summary information on preparations and tests performed on cavities in chronological order from *Summary of Works/Cavity* in the GUI. A specific cavity has to be selected from the list.

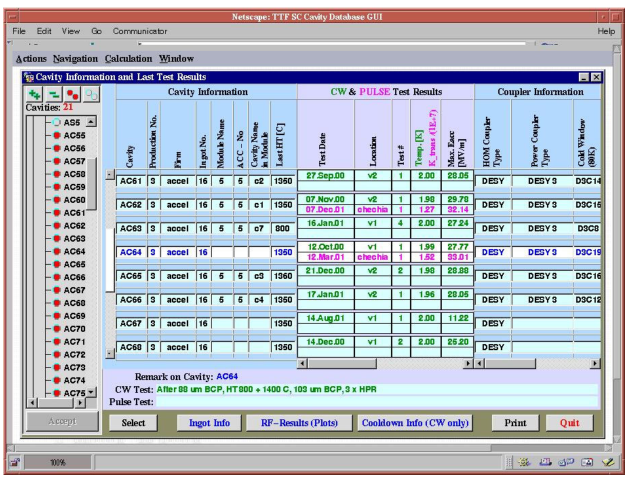

Figure 4: Results of last cw and pulsed tests of selected cavities from *Summary of Last RF Tests* in the GUI. A group of cavities can be selected.

Report Generation System

In order to make hardcopies of the results provided by the GUI a Report Generation System (RGS) was developed (Fig. 5). This RGS is based on ORACLE REPORTS and GRAPHICS and produces *Table*, *Graphical* or *Informational (combined) Reports*. Alternatively the RGS may generate Postscript, HTML, XML, PDF or TEXT (ASCII) files which then can be used by MS EXCEL or other tools to present the data in a user-defined style. Fig. 6 shows an MS EXCEL plot based on the ASCII file produced by the RGS called from *Summary of Last RF Tests* in the GUI.

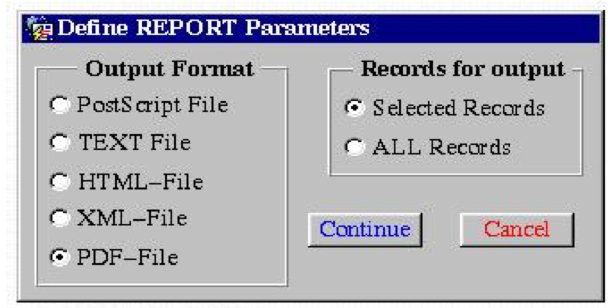

Figure 5: Report Generation System (RGS) of the GUI.

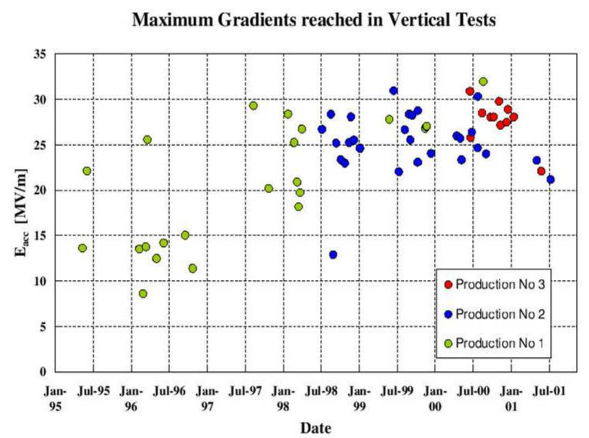

Figure 6: Maximum gradients reached in vertical tests. It is provided by MS EXCEL based on the ASCII file generated by the RGS called from *Summary of Last RF Tests* in the GUI.

FUTURE DEVELOPMENT

The actual database should help to fix the final treatment procedures of the superconducting cavities for the proposed XFEL Linac. In future the database should become an effective part of the Quality Management System for the XFEL cavities.

REFERENCES

[1] D.A. Edwards, TESLA Test Facility Linac – Design Report, TESLA 95-1, 1995.

[2] B. Aune et al., “Superconducting TESLA Cavities”, Phys. Rev. ST Accel. Beam 3, 092001, 2000.

[3] P.D. Gall et al., “The Superconducting Cavity Database for the TESLA Test Facility”, Proceedings of the 10th Workshop on RF Superconductivity, Tsukuba, Ibaraki, Japan, p.352, 2001.