Superconducting Cavity Database for TTF

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ABSTRACT

A database has been developed to collect data about the superconducting cavities from the production phase to the operation in the TESLA Test Facility (TTF)-linac [1]. This database was implemented using the ORACLE RDBMS (Relational Database Management System). The human interface was created using the ORACLE applications FORMS, GRAPHICS and REPORTS.

1. INTRODUCTION

More than 60 cavities will be installed in the TESLA Test Facility (TTF) at DESY. Cavities, produced by different European companies are tested at DESY and then assembled and installed as modules of eight cavities in the TTF-linac. We decided to collect selected data, characterizing the cavities, into a relational database to assure a reliable tool for comparisons and analyses by accessing the data from wherever in the TESLA Collaboration.

2. DATABASE STRUCTURE

The user data are stored into tables, the basic structure of a relational database. In many discussions with the different domain experts we created a database structure manifesting for each cavity the main treatments and measurements. The data can be divided into ones obtained under 'warm' and under 'cold' conditions.

There are essentially six 'warm' sets of data attached to the cavity:

- Production data coming from the cavities manufacturers and from the entrance control at DESY;
- Information about the material used to build the cavities;
- Cavity tuning measurements;
- Temperature, pressure and mass spectra from the heat treatments of the cavities in 2 different furnaces;
- 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 test-stands.

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The four 'cold' sets of data related to the cavity are:

- Temperature spectra from cooling down the cavities;
- Results of the cw tests of the cavities;
- Data from cavity tests under pulsed condition;
- Information about testing and conditioning of input couplers.

One or more tables are used to describe the different data sets (Fig. 1). Each table is related to a specific cavity by the cavity name and a timestamp for the treatment or measurement.

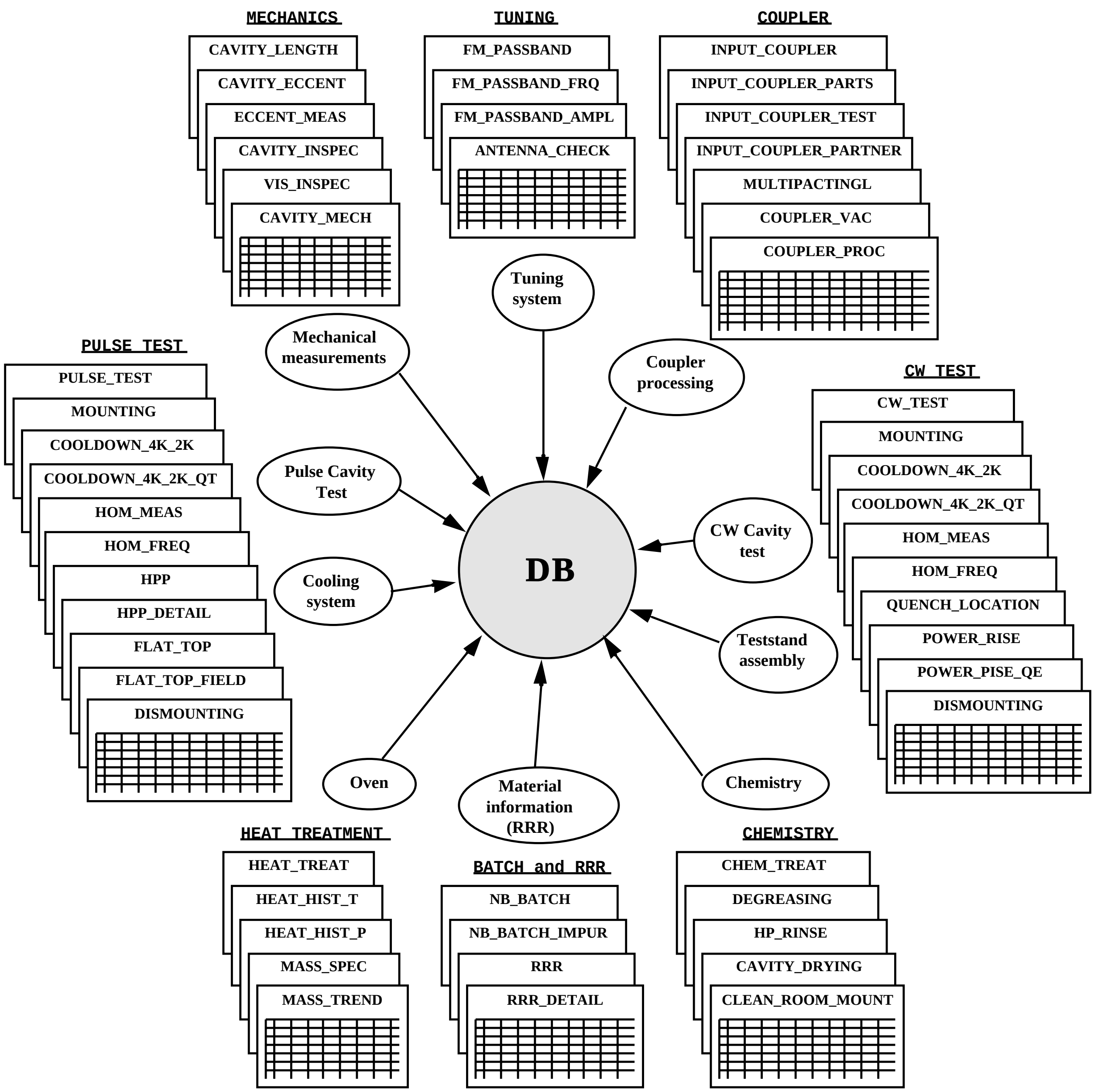


Fig. 1: Schematic structure of the database.

We use the ORACLE Relational Data Base Management System (RDBMS) on a UNIX machine to realize our conceptual model. The ORACLE RDBMS is accessible via SQL*Net from all the different computer platforms the TESLA Collaboration is using. ORACLE uses a 4th generation language and allows complex queries and data crossing. Data protection and security is guaranteed by the DESY central computer service.

3. DATA COLLECTION

Data collected from different treatments and measurements using different host computers are sent by the operators as ASCII files to a central VAX/VMS machine. The files are catalogued for book-keeping and to assure the possibility to load the data again what turned out to be important in the developing phase of the database. The data are loaded to the database structure using embedded SQL (Pro*FORTRAN) to handle the data files.

4. GRAPHICAL USER INTERFACE

A Graphical User Interface (GUI) based on the ORACLE applications FORMS, GRAPHICS and REPORTS has been created in order to facilitate the use of the database. Some frequently asked questions to the database were anticipated in this GUI which at the moment allows essentially only to retrieve data from one or more tables or views. All components of the GUI are started from the "START WINDOW" containing a set of buttons with a brief description of applications related to them. This window appears when you start to work with the TTF SC Cavity Database GUI (Fig. 2).

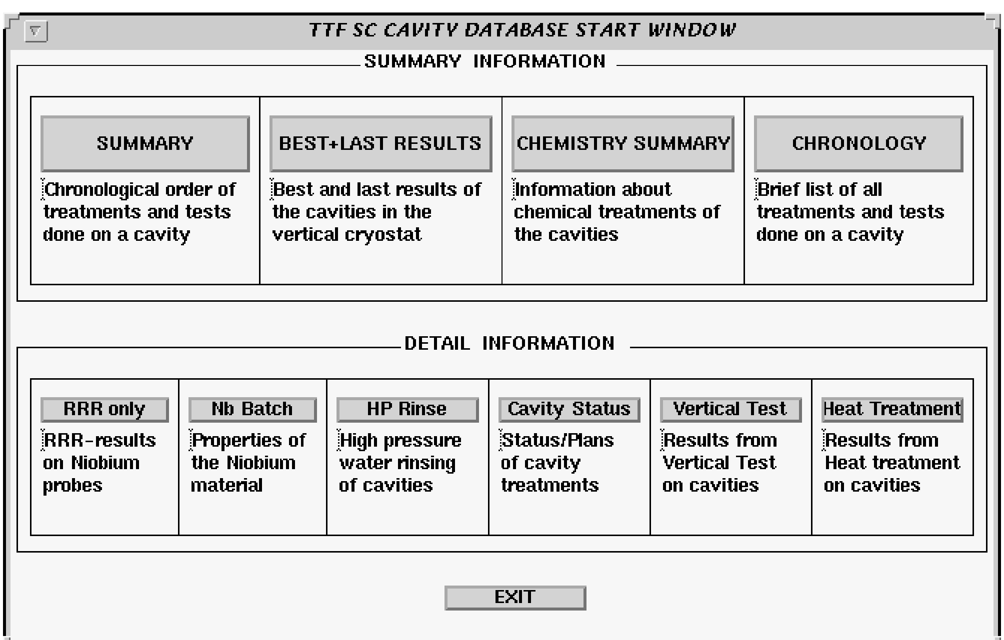


Fig. 2: Start menu of the TTF SC Cavity Data Base graphical user interface (GUI).

By pressing the "SUMMARY" button a window, containing information on most important treatments and tests performed on a cavity in chronological order, is opened (Fig. 3).

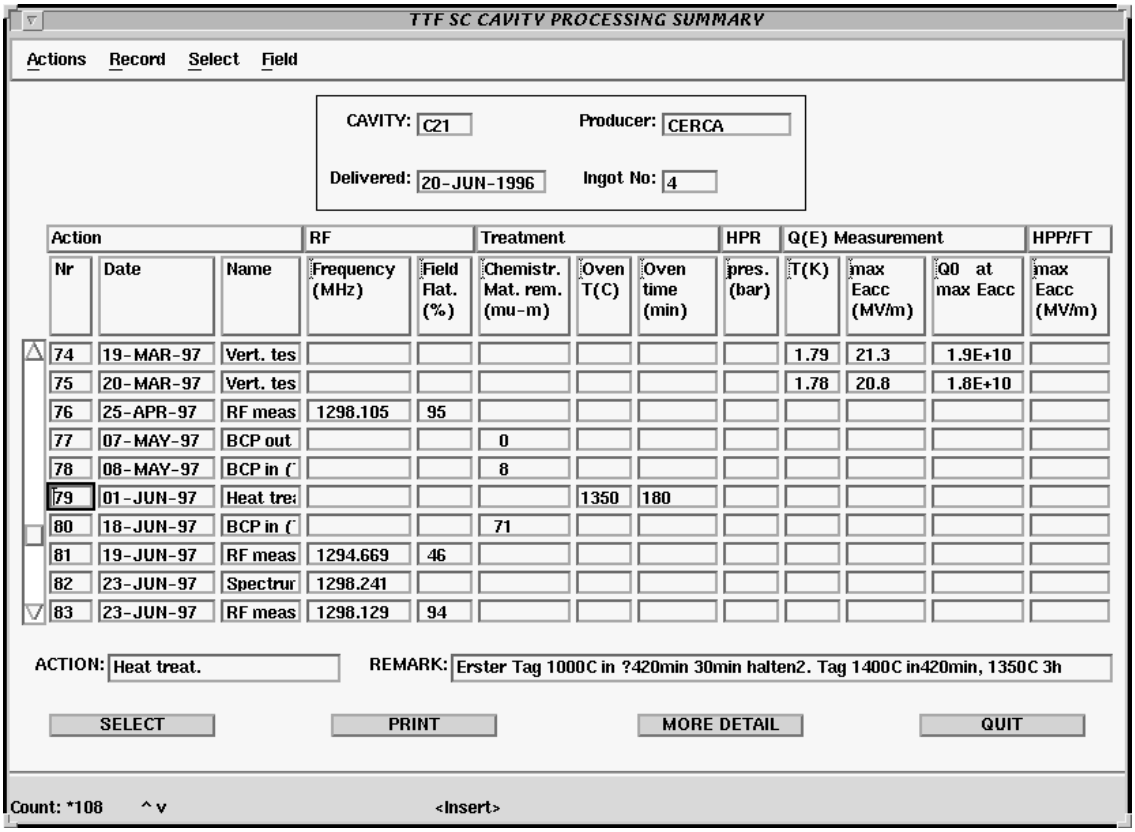
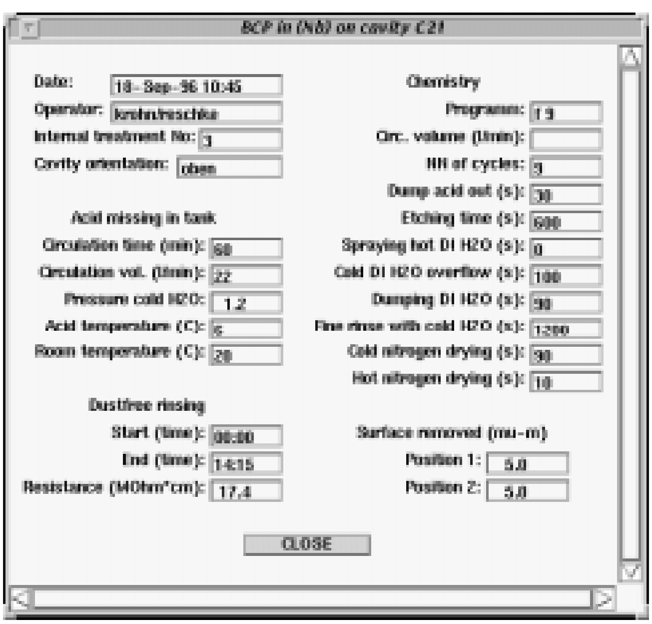


Fig. 3: Summary information from treatments and tests done on a cavity in chronological order



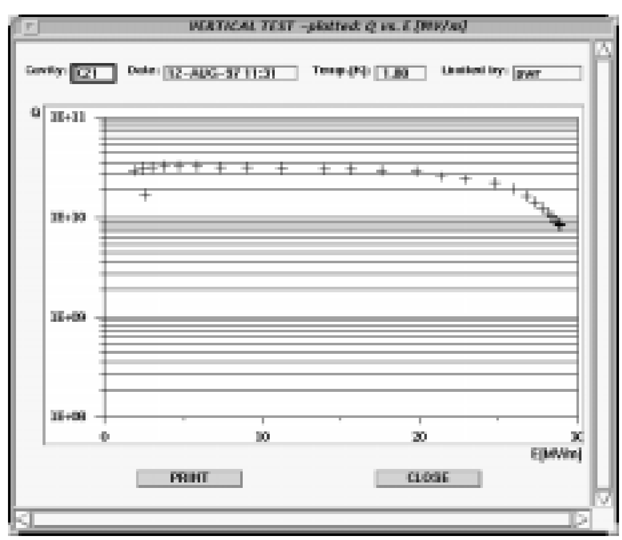


Fig. 4a: Detailed information on chemical treatment.

Fig. 4b: Detailed Q(E)-graph from from vertical test.

BEST AND LAST MEASUREMENTS IN VERTICAL CRYOSTAT

Actions Record Select Field

Cavity	Best measurement: max Eacc (MV/m)	Q0 at max Eacc	Limit by	Heat treat. T(C)	Surface removed (mu-m)	Last measurement: max Eacc (MV/m)	Q0 at max Eacc	Limit by	Heat treat. T(C)	Surface removed (mu-m)	Status/Plans
C21	29.3	8.4E+09	pwr	1350	151	29.3	8.4E+09	pwr	1350	151	28 MV/m reached after heat treatment at 1400 C - ready for
C22	19.4	3.6E+09	pwr	1350	125	9.9	7.1E+08	pwr	1350	125	ready for tank welding (needs field flatness check)
C25	23.9	5.2E+09	pwr	800	65	23.8	4.8E+09	pwr	800	65	preparation for 1. vertical test
D1	24.7	1.7E+10	bd	1400	145	23.1	2.2E+09	pwr	1400	145	assembled to 1. module
D2	21.9	3.7E+09	fe	1400	133	17.9	5.1E+09	fe	1400	163	assembled to 1. module
D3	25.6	3.2E+10	bd	1400	179	25.6	3.2E+10	bd	1400	179	assembled to 1. module
D4	13.5	1.6E+10	bd	1400	351	13.5	1.6E+10	bd	1400	351	assembled to 1. module
D5	8.6	3.5E+09	bd	1400	241	7.1	1.1E+09	bd	1400	298	helium tank welding - serves as test cavity for CHECHIA

SELECT QE GRAPH PRINT QUIT

Count: *26 ^ v <Insert>

Fig. 5: Best and last results from vertical tests done on cavities.

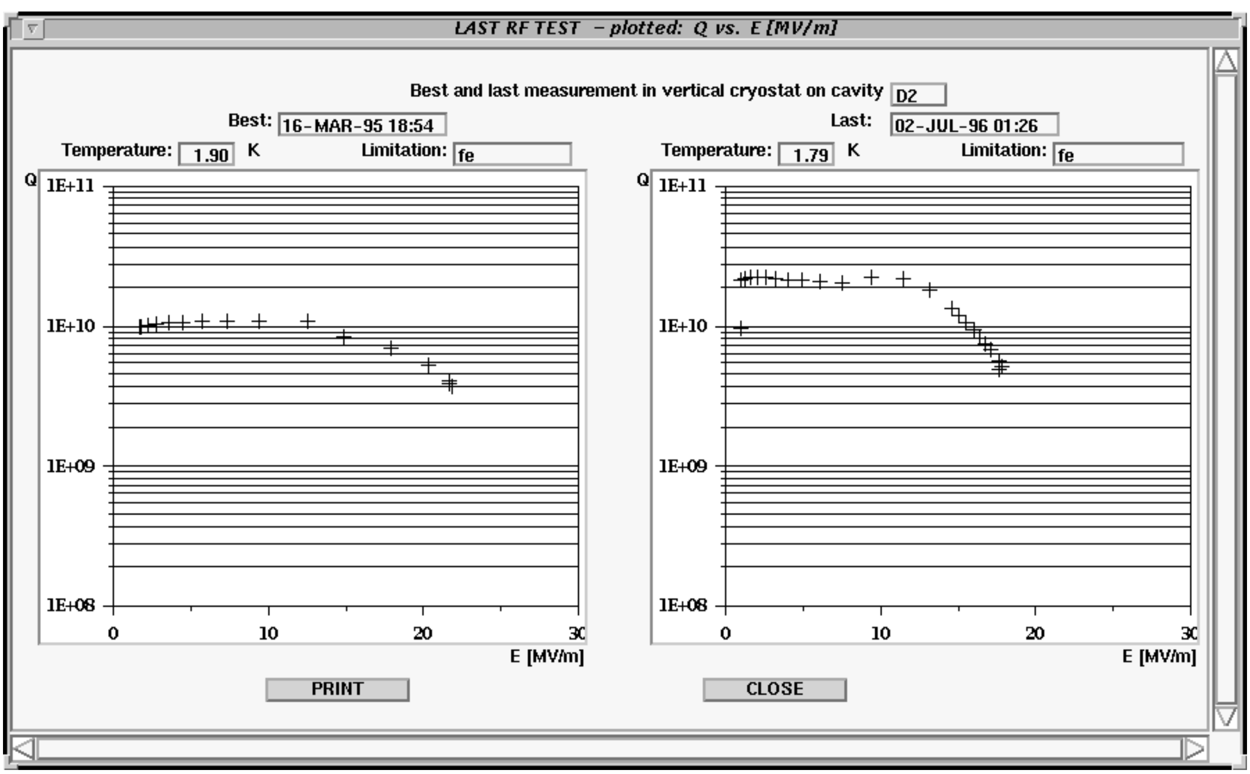


Fig. 6: Q(E)-curves of the best and last result obtained on cavity D2 in vertical tests.

The outfit of this and all other windows has been developed in permanent interaction with the people involved. More detailed information can be obtained for almost all items in this summary (Fig. 4a, b).

By pressing the corresponding button in the start menu the best and last results from the cw tests of the cavities in the vertical cryostat are displayed together with some important parameters from the treatments the cavities have passed before this test (Fig 5). The corresponding Q(E)-graphs are shown by a click to the "QE-GRAPH" button (Fig. 6).

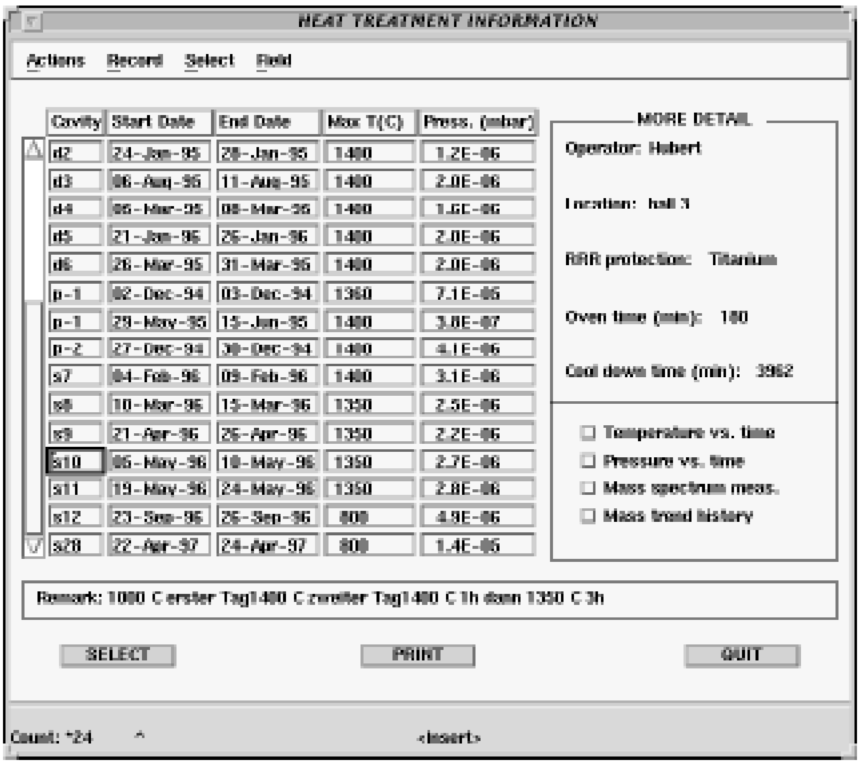
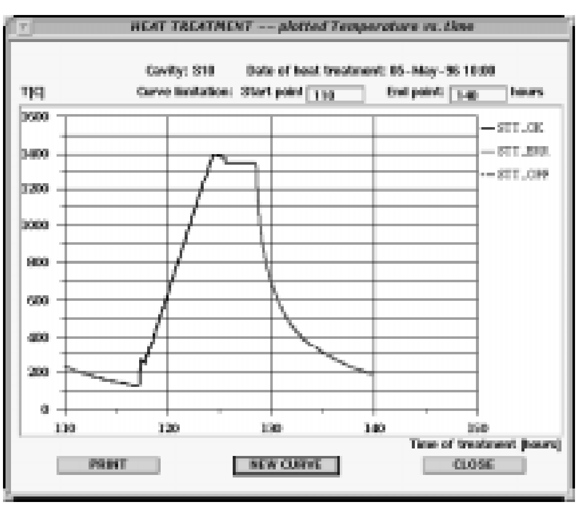


Fig. 7a: Full information from heat-treatments done on cavities



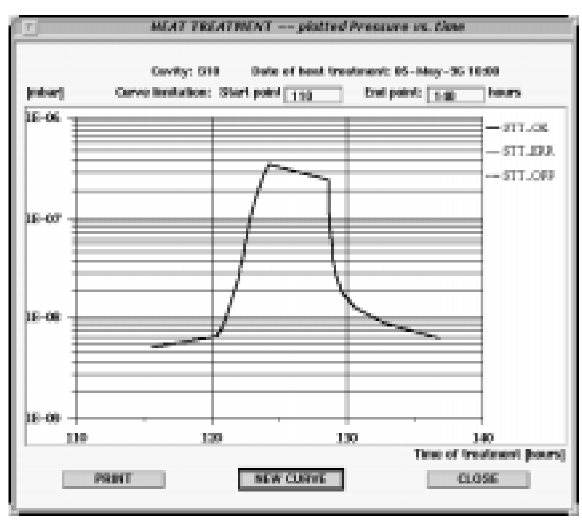


Fig. 7b: Temperature development heat-treatment.

Fig. 7c: Pressure development during during heat-treatment.

Another helpful GUI window contains information on the heat treatment of the cavities (Fig. 7a). By pressing the button "temperature vs time" or "pressure vs time" the temperature and pressure spectra respectively are displayed as a function of the treatment time (Fig 7b, c).

The windows of the GUI have "PRINT" buttons which call the "REPORT GENERATION SYSTEM" (RGS). The RGS allows that the information displayed by the current form is either saved in the file system as postscript and/or ASCII file or sent directly in postscript format to a selected printer (Fig. 8).

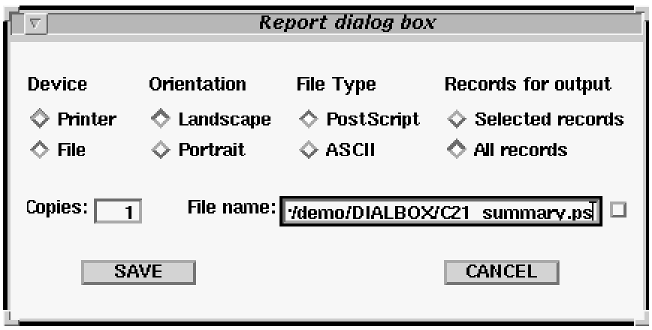


Fig. 8: Dialog box for saving information into a file and for printouts.

5. FUTURE DEVELOPMENTS

In the future the database structure has to be enlarged to take into account the measurements performed on the modules containing eight cavities and finally on the whole TTF-linac. For this and all further developments it is important to have a very good coordination and interaction with the people involved, especially to assure an effective feedback to improve this database. In order to make the GUI accessible to more and more users we intend to increase the power of the existing interface by using the ORACLE WebServer to generate dynamic Web-pages which will contain the actual information of the database.

REFERENCE

[1] D. A.. Edwards: TESLA TEST FACILITY LINAC - Design Report, TESLA 95-01, 1995