A DATABASE FOR THE EUROPEAN XFEL

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Abstract

More and more the database takes over an effective part of the quality control system for the whole cavity production and preparation process for the European XFEL on a very detailed level. Currently we try to find out the most effective and safe way to get the production data from the different companies to the database and to control the quality of the cavity production from the Niobium sheets to the complete modules in the linac. At the moment the database contains information about 250 9-cell cavities, 7000 half cells, 2200 dumb bells and 500 end groups.

A DATABASE FOR XFEL CAVITIES

Beginning from TTF a relational database for cavities was developed at DESY using the ORACLE Relational Database Management System (RDBMS) [1].

The database is dynamically accessible from everywhere via a graphical WEB interface based on ORACLE. At the moment we use the version Oracle Developer 10g Forms and Reports and graphical tools are based on Java.

The XFEL database is a very useful and reliable tool (quality management system) for companies and scientists from all over the world.

Via the link http://xfel.desy.de , you can enter the area "Cavity Database" and then decide between the cavity production part and the RF measurements (see Fig. 1). In the cavity production part you, as an authorized user, have access to half cells, dumb bells, end groups, cavity for XFEL and cavity in helium tank [2].

The database is created to store data for more than 800 cavities coming from the serial production. These 9-cell cavities are produced by different European companies for the XFEL project. The superconducting cavities have been prepared and mostly tested at DESY in order to optimize the production and preparation techniques. Therefore the main aim of the database is to store data about cavity production, cavity preparation and cavity measurement steps.

The database describes and controls the different development steps. For this, an exchange of data between DESY and CEA, where the strings and modules are assembled, is needed. Therefore we can consider the XFEL database as an ON-LINE data storage system[2].

We developed tools to analyze the data stored in the database for different groups of experts, which have access via WEB.

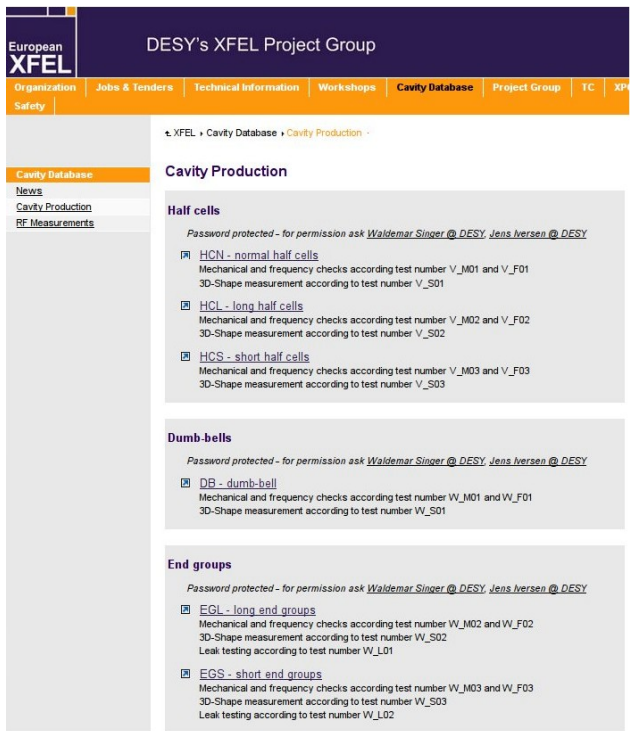

Figure 1: Start page for XFEL database GUI.

DATAFLOW IN THE XFEL DATABASE

In general there exist 3 levels of the cavity production steps called acceptance level (AL1, AL2, AL3):

- Acceptance level 1 includes the fabrication of half cells, dumb-bells, end groups, and cavities.
- In acceptance level 2 cavities are prepared and assembled into a helium tank.
- The final cavity preparation takes place in acceptance level 3.

Data from these acceptance levels are send to the database via EDMS (see Fig. 2).

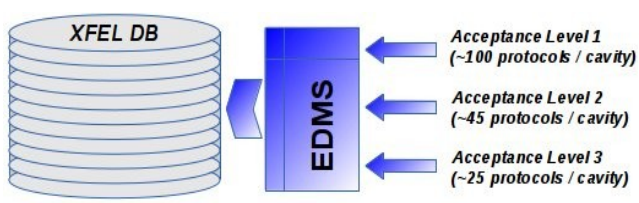

Figure 2: Cavity production dataflow.

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Data from RF measurements and tests done at DESY AMTF (Accelerator Module Test Facility) are exchanged via direct database-database connection. Every hour an automatic system looks for new data and starts loading if it's present (see Fig. 3).

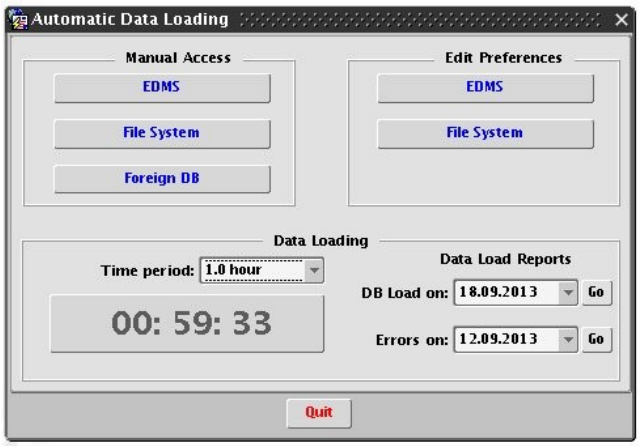

Figure 3: Data loading user interface.

Some data, e. g. from CEA, are sent by files using uploading tools (see Fig. 4).

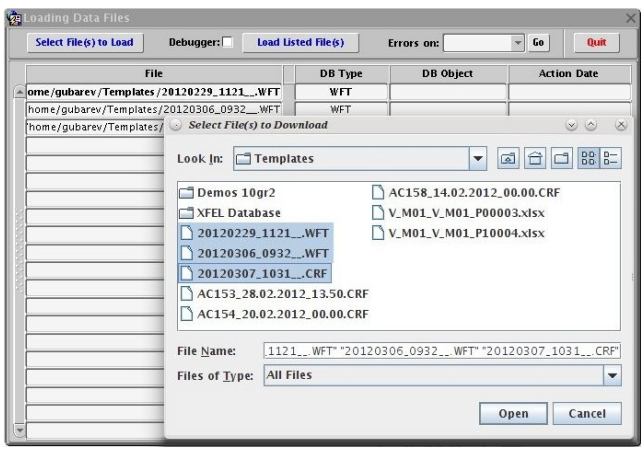

Figure 4: Uploading tools.

QUALITY CONTROL SYSTEM

AL1: In this step the naked cavities and their parts are checked.

- Half cells, dumb bells, end groups:
  - Mechanical and frequency checks
  - 3D-Shape measurement
- Cavity
  - Mechanical properties
  - Frequency check

AL2: Here the preparation of the cavities with and without tank is analyzed.

- Transfer measurements
- Eccentricity measurements
- Mechanical property of cavities in tank
- Cavity preparation steps
- Frequency check of cavity in tank

AL3: Further preparations, like heat treatment, final chemical polishing and final RF measurement of the cavities in tank are checked in this level.

On each level it is decided by experts if the cavity or its parts can be used for an XFEL cavity. To assist the experts in the applications the fields are marked by colours (see Fig. 5).

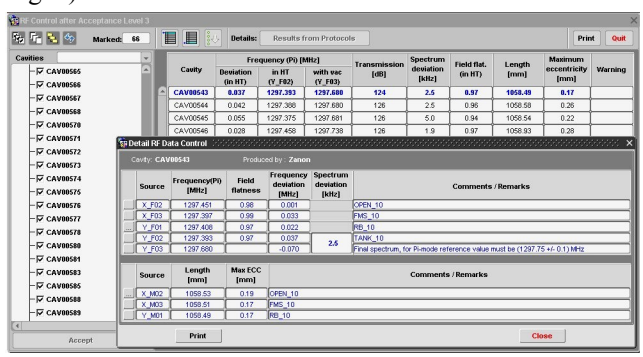

Figure 5: RF quality control for AL3.

Since the cavities are produced by different European firms, their data are not free accessible. Only authorized users have access to these data.

RF-Test in vertical cryostat: The quality Q and the radiation losses is shown as a function of the gradient (Q vs E, Xray vs E, see Fig. 6). Based on this experts can decide if a cavity has to be retreated or not [2].

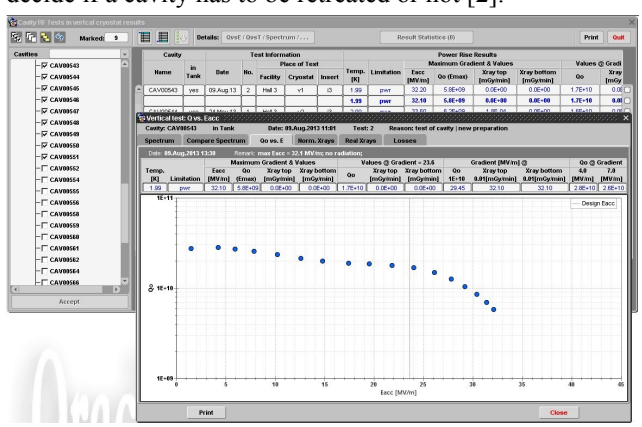

Figure 6: RF-Test results with curves.

Transportation control: To detect via RF spectrum measurements problems during transportation of cavities and modules.

String mounting: To position the cavity in the string a recalculation of the 3D transfer measurements is done. For this we use the last eccentricity measurements, providing the electrical axis of the cavities.

We are planning to extend the database for modules and their parts, like tuning systems, couplers, magnets...

REFERENCES

[1] P.D. Gall, et al., "A database for the superconducting cavities for the TESLA Test Facility", PHYSICA C 441 (1006) 272-276.

[2] "XFEL Technical Design Report", DESY 2006-097, http://xfel.desy.de.

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