ESS PARAMETER LIST DATABASE AND WEB INTERFACE TOOLS

K. Rathsman, S. Peggs, P. Reinerfelt, G. Trahern, ESS, Lund, Sweden
J. Bobnar, Cosylab, Ljubljana, Slovenia

Abstract

The European Spallation Source is an intergovernmental project building a multidisciplinary research laboratory based upon the world's most powerful neutron source. The main facility will be built in Lund, Sweden. Construction is expected to start around 2013 and the first neutrons will be produced in 2019. The ESS linac delivers 5 MW of power to the target at 2.5 GeV, with a nominal current of 50 mA.

The Accelerator Design Update (ADU) collaboration of mainly European institutions will deliver a Technical Design Report at the end of 2012. To ensure consistency of the information being used amongst all subgroups throughout the period of accelerator design and construction, a parameter list database and web interface have been proposed. The main objective is to provide tools to identify inconsistencies among parameters and to enforce groups as well as individuals to work towards the same solution. Another goal is to make the Parameter Lists a live and credible endeavor so that the data and supporting information shall be useful to a wider audience such as external reviewers as well as being easily accessible.

BACKGROUND

The current ESS parameter list consist of a selection of xls spread sheets that are posted on the ESS accelerator division home page [1]. This solution has the advantage of being simple, however the number of tables and parameters are expected to increase as the project evolves. Therefore, for the purpose of organizing the parameters more efficiently in a database system, the content and usage of these tables have been analyzed. The following issues have been identified:

- Some parameters appear more than once in the parameter table.
- Parameter names appear more than once in the same table, referring to different systems.
- Many parameter names begin with maximum, minimum or other attributes.
- There is no hierarchical structure amongst the parameter tables.

As a compromise between our ambition of avoiding complexity on one hand and the possibility of developing a system fully integrated with the IT infrastructure at ESS on the other hand, we propose a database that is indeed adapted to the general structures and conventions at ESS, but nevertheless stands alone, at least to begin with. This will also make it straightforward for other groups outside of the accelerator division to make use of the system.

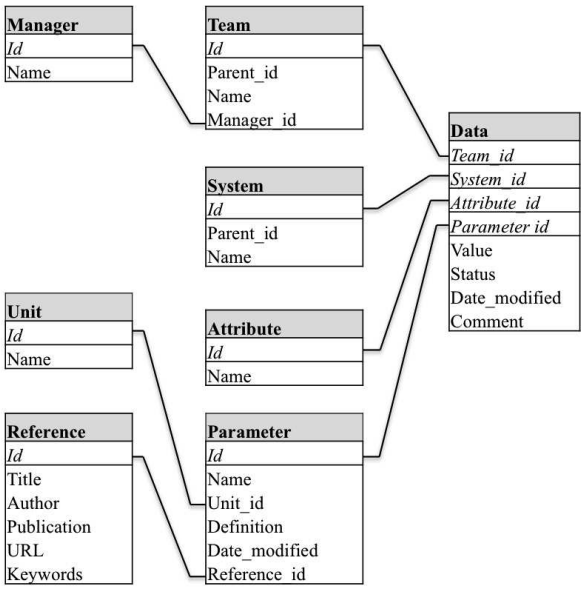

Figure 1: The database is made up of five relational tables.

THE DATABASE STRUCTURE

The proposed parameter list database will be relational and normalized to at least the 3NF level [2]. The relationship between the different tables Team, Manager, System, Attribute, Parameter, Unit, Reference and Data is shown in Fig. 1.

Team

The parameter list can be envisaged as a communication tool within and between different groups and individuals in the collaboration. It is therefore natural to categorize parameters by teams, or roles within the teams. For convenience we will adapt the already established Work Breakdown Structure (WBS) of the project, preferably in the Prepare to Build (P2B) phase.

The tables Team and Manager have been introduced to reproduce a normalized database structure of the WBS. Manager does in principle not have to be listed in the database (this information can be found elsewhere in the organization). However, deviations from the WBS should not be precluded. Furthermore, the role of the manager in this context is as a parameter owner with privileges to administrate parameters in the database.

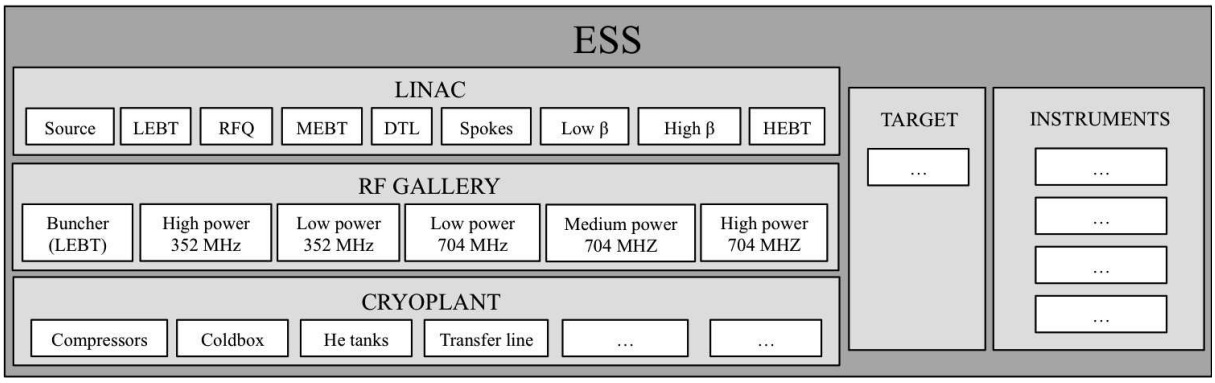

Figure 2: Schematic layout of the system structure.

System

The second classification of the parameters is by system. This can for example be the High beta elliptical cavity section or the 704 MHz High power rf source in the Klystron gallery. A conceptual hierarchal system structure of the facility is shown in Fig. 2. This scheme is preliminary and is likely to be replaced a general structure of ESS. To the first level, System corresponds to the large scale parts of the facility. Depending on the degree of detailed information the database will be used for, it might be convenient to add further levels, down to individual cavities in the Linac. Although the parameter database is not the appropriate tool for administration of lattice parameters (these reside in the lattice database), the parameter database could be useful as a repository for parameters not included in the lattice database, for example the rf power sources associated to each of the accelerating cavities.

Attribute

The Attribute is optional. It has been introduced to distinguish between nominal, minimum or maximum values of a parameter. Upon request it is straightforward to add other attributes to describe parameters as approximate, averaged, specified or underground, etc.

Parameter

The Parameter table accounts for the definition of the parameters and units. It also contains a text field allocated for a detailed description of the parameter definition.

Data

The primary key of the Data table is a tuple of Team, System, Attribute and Parameter. Each record in the Data table will therefore be uniquely identified through this relation and consequently a parameter can apply to several systems and teams of the facility.

The field Status can be assigned as Draft, (default), Valid, Obsolete or Requested. A parameter becomes active after validation, which is supposed to be carried out according to the present routine, namely in committees arranged among the owners.

Parameters that are no longer used change status to Obsolete. Requested has been introduced to allow a team to request data from a another team by adding a parameter in the name of the other team.

WEB INTERFACE TOOLS

Edits

To ensure that the parameter list will be alive, the access for the team managers has to be versatile, self-explanatory and efficient. Therefore we have chosen to use Java based web interface tools. A certain amount of control needs to be established, for example, for units and user privileges, nevertheless this should be kept to a minimum.

Dependencies

A major part of the parameters depend upon each other in a complicated way. These relations are not visible in the database. Only numbers will be validated and formulas are therefore not allowed in the database. Nonetheless, applications to relate parameters and identify inconsistencies will be developed. This might require an elaborate unit control [3].

Queries

Query tools will be developed to generate parameter lists in a readable fashion, similar to the present parameter lists on the ESS-AD home page. As a template we plan to use the parameter lists of SNS [4] and JPARC [5].

Parameter Application

To support reporting or to quickly look up a parameter, we will develop applications that downloads to either the computer or mobile phone. These will contain search fields and filtering of Team, System and Parameter to efficiently find the desired parameter.

REFERENCES

[1] ESS Accelerator Division, http://www.esss.se/linac.

[2] C. J. Date. *An Introduction to Database Systems*. Addison-Wesley Longman, 1999. ISBN 0-321-19784-4.

[3] Matúš CHOCHLÍK. Storing Dimensions and Units of Physical Quantities in a Relational Database. *Acta Electrotechnica et Informatica*, 8(3):61–65, 2008.

[4] SNS Parameters List, SNS 100000000-PL0001-R13, 2005. http://neutrons.ornl.gov/media/pubs/pdf/sns_parameters_list_june05.pdf.

[5] Accelerator technical design report for High-intensity Proton Accelerator Facility Projest, J-PARC, JAERI-Tech 2003-044, 2003. http://jolissrch-inter.tokai-sc.jaea.go.jp/pdfdata/JAERI-Tech-2003-044.pdf.